THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVI. No. 1438.] LONDON, DECEMBER 2, 1890. [42ND YEAR. Price 6d.

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Prices and Analysis of all the Scotch Cannels on application.

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OF VARIOUS SIZES,
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Parker's Imperial Black Varnish,
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Special Quotations to Gas Companies.
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Portland Cement
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Illustrated Pamphlet and Terms on application to J. E. FISHER, Stourbridge, Agent for England and Wales; to C. M. HAMILTON, Portland Place, Hamilton, Agent for Scotland and Ireland; and for all other Countries to the Patentee,
Geo. R. HISLOP, Gas Engineer, PAISLEY, N.B.

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Which has now fully proved itself to be the most effectual, powerful, and perfect Apparatus in the World,
FOR PURIFYING GAS FROM
TAR, CARBONIC ACID, AMMONIA,
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Doing all the work of Purification between the Condensers and Purifiers, and relieving them of much work.
Its cost is less than any other known Apparatus for purifying Gas from Tar and Ammonia.
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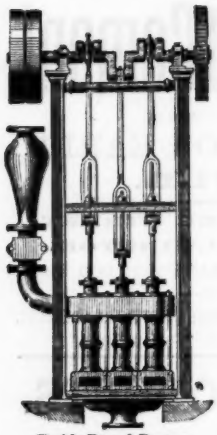
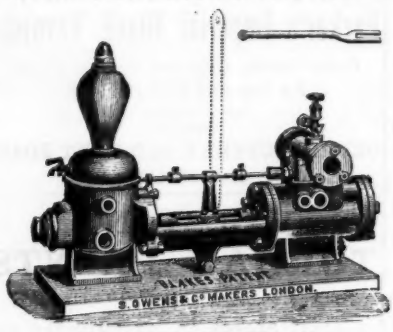
FOR PUMPING TAR, WATER, AND LIQUOR.



Treble-Barrel Pumps in Frame.

Syphon Pump.

Double-Barrel Force-Pump in Frame.



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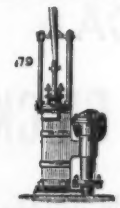
STEAM PUMPS.
20,000 IN USE.



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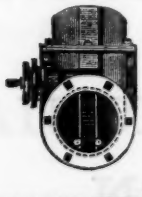
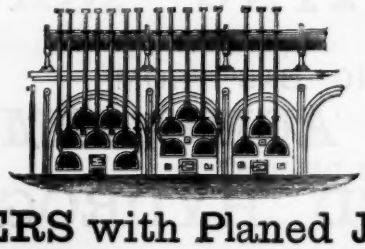
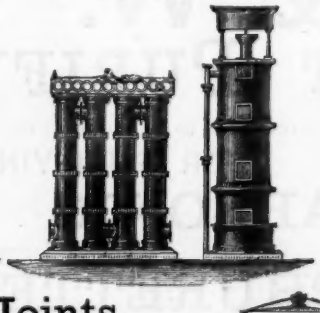
Also Bye-Pass & Stop Valves.







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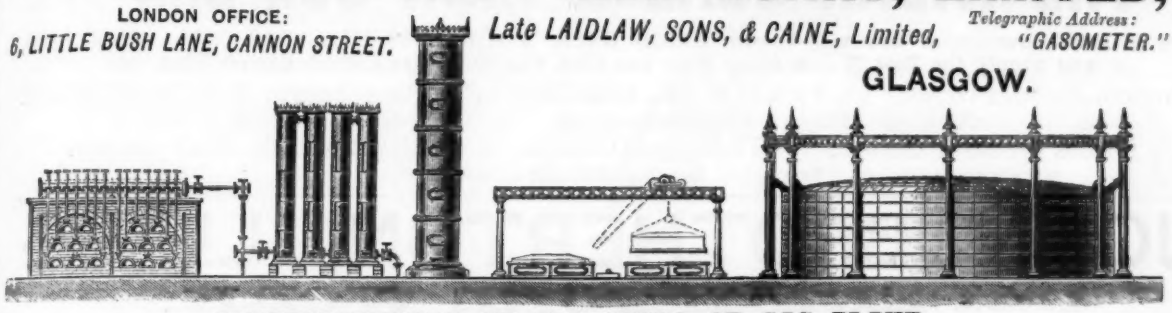

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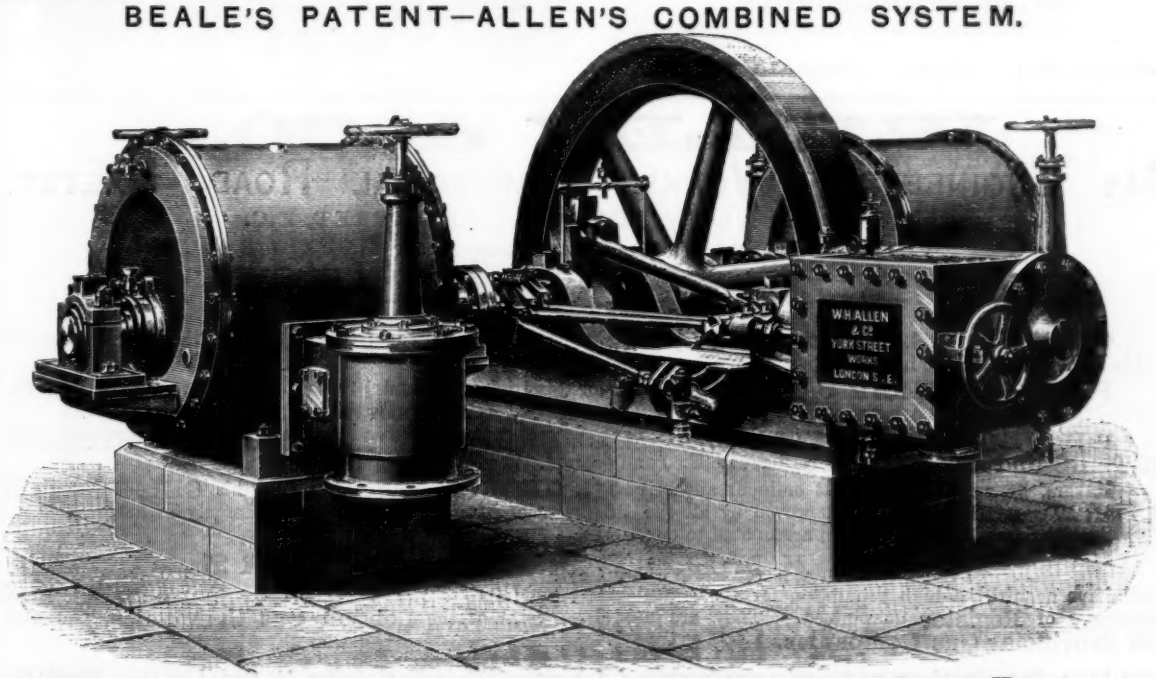

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Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

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COILS OF ALL SIZES AND SHAPES.

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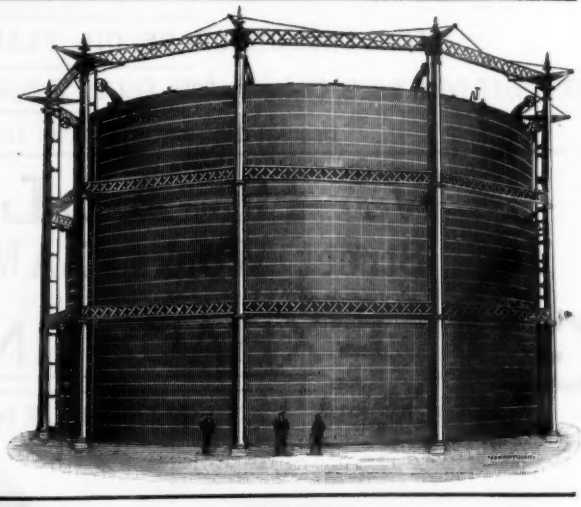

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PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

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Makers, by permission of that eminent authority **Mr. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

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WET AND DRY METERS,

which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

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MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

ESTABLISHED MORE THAN A QUARTER OF A CENTURY

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MAKE A

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JOHN BROWN & CO., LTD., SHEFFIELD,

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ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
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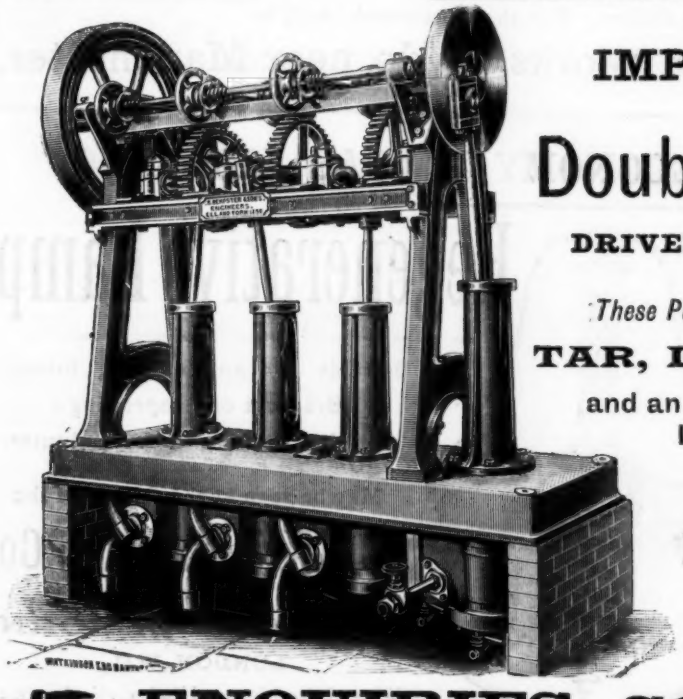
ESTABLISHED — **ELLAND.** — 1855.



IMPROVED BATTERY
OF THREE
Double-Acting Pumps
DRIVEN BY ONE STEAM-ENGINE.

These Pumps are fitted with Valves for pumping
TAR, LIQUOR, and WATER,
and an arrangement by which any of these Liquids may be pumped together or separately.

BEST MATERIALS AND WORKMANSHIP,
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DR. FELDMANN'S APPARATUS

The most successful and approved Apparatus known up to the present time.

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The Apparatus has been supplied to the following Firms—

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JOHN RUSCOE calls attention to his Retort Mouthpiece and Lid Facing Machines, which are in extensive use; also to his Lathes, Drilling, Slotting, Grooving, and Planing Machines, Smiths' Hearths, Smithy Fans, Roots' Blowers; also special Screwing Machines for Gas Tubes and Bolts, Taps, Wrenches, Pipe Cutters, special Taper and Twisted Rymers, Drills, &c.

PATENT TWISTED TAPS, DIES, & CUTTERS.

Thousands in constant work, give universal satisfaction.

Work Easier, Less Friction, Last Longer, and do Better Work than straight Grooves.

Main Drilling Stand, with Cup Drills, 1¼ to 6 inch; Taps, Rymers, and Drills.

Ratchet Screwing Stocks, and Adjustable Once-up Stocks, Dies, Guides, &c.

Inquiries and Trial Orders Solicited. Everything Guaranteed. Apply to

JOHN RUSCOE, Albion Works, Hyde, near Manchester.

SIXTY PER CENT. ECONOMY IN GAS LIGHTING.

The Schülke Regenerative Lamp

FOR

DOMESTIC AND EXTERNAL LIGHTING.

The only Regenerative Lamp employing the Common Flat-Flame Burners.

Lamps giving 20-Candle power consume less than four feet of Gas per hour.

PURE WHITE & PERFECTLY STEADY LIGHT,

NOT AFFECTED BY DRAUGHTS.

Suitable for any existing fittings (Brackets or Suspending).

Can be fixed in a few minutes.

May be seen at the Offices of the

SCHÜLKE GAS-LAMP Co.

LIMITED,

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Where Price Lists and full particulars may be obtained.

KIRKHAM, HULETT, & CHANDLER'S, LTD.,

NEW PATENT

"STANDARD" WASHER.

EXTRACTS the WHOLE of the AMMONIA

Also a Large Proportion of H_2S and CO_2 from Gas.

Has been in operation over two years at the Beckton Station of The Gaslight and Coke Company. (See below.)

TESTIMONIAL FROM THE CHIEF ENGINEER OF THE GASLIGHT AND COKE COMPANY.

The Gaslight and Coke Company, Horseferry Road, Westminster, S.W.,
Nov. 25, 1889.

Messrs. KIRKHAM, HULETT, AND CHANDLER, LIMITED,

GENTLEMEN,—In reply to your enquiry respecting the result of putting "Wooden Bundles" into some of the Washer-Scrubbers at our Beckton Station, I beg to say they have answered admirably for the few months they have been in; and I think them a decided success.—I am, yours truly,

(Signed) G. C. TREWBY.

NOTE.—The first Washer referred to in the above was fitted with improved "Bundles" in May, 1888; *and these have proved so satisfactory that The Gaslight and Coke Company have had several other "Standard" Washers fitted in the same manner, and have recently given an order for machines for 6,000,000 cubic feet per day.*

For List of "Standard" Washer-Scrubbers supplied of above-mentioned pattern and renewals effected by application of same to old pattern machines, see last and next weeks' issue of the JOURNAL.

PALACE CHAMBERS, BRIDGE STREET,

WESTMINSTER, S.W.

R. & J. DEMPSTER,

GAS PLANT WORKS, NEWTON HEATH, MANCHESTER,

MAKERS AND ERECTORS OF

PATENT COLUMNLESS GASHOLDERS,

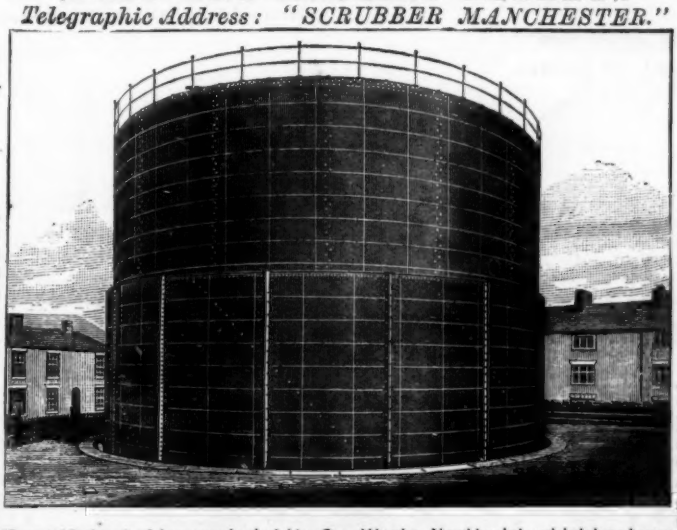
(GADD AND MASON'S PATENT).

Telegraphic Address: "SCRUBBER MANCHESTER."

TOTAL WEIGHT REDUCED
from 30 per cent. to 50 per cent.

TRANSPORT AND ERECTION REDUCED
to the same extent; and in cases where gasholders are shipped abroad to places difficult of access, this represents a very large amount of money.

TANK CONSTRUCTION SIMPLIFIED.
The Tank wall (of whatever construction) is a regular cylinder. There are no piers needed, and all expensive foundation stones for the base of columns or standards are dispensed with.



Two-Lift Gasholder erected at the Gas-Works, Northwich, which has been in continuous work since Jan. 3, 1890, and has been subjected to most severe tests from heavy gales, with perfectly satisfactory results.

COST OF PAINTING SAVED
for the Columns and Girders.

TILTING UTTERLY IMPOSSIBLE;
And as there are fewer parts, there is less liability for the Gasholder to get out of order in working.

STABILITY UNDER WIND PRESSURE
of a Gasholder constructed upon this system is at least equal to, and from experiments and calculations made is far in excess of, that of a Holder of the same dimensions guided by the elaborate guide framing at present in use.

The removal of heavy guide carriages and rollers from the top curbs considerably lowers the centre of gravity of the structure, and dispenses with the extra strength of sheeting necessary to carry these at the points where they are attached to the gasholder.

The plan adapts itself to telescoping to any reasonable extent, and enables very shallow holders or lifts to be employed with perfect stability.

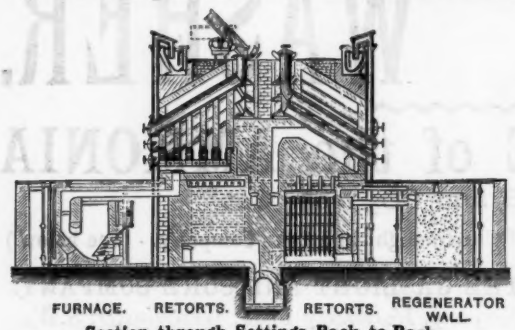
For further particulars and estimates, apply to the above, or to

THE PATENT GASHOLDER SYNDICATE, 504, STOCKPORT ROAD, MANCHESTER.

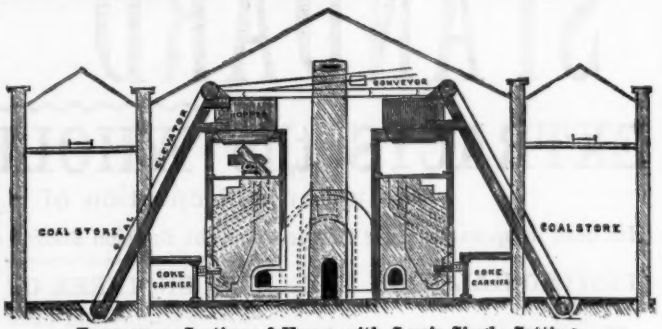
AUTOMATIC SYSTEM OF CHARGING & DRAWING INCLINED GAS-RETORTS.

Gold Medal, Paris Exhibition, 1889.

This System of Automatically Charging and Discharging Retorts without machinery or arduous labour is in operation at several places on the Continent and in America, and will shortly be at work in various Gas-Works in England.

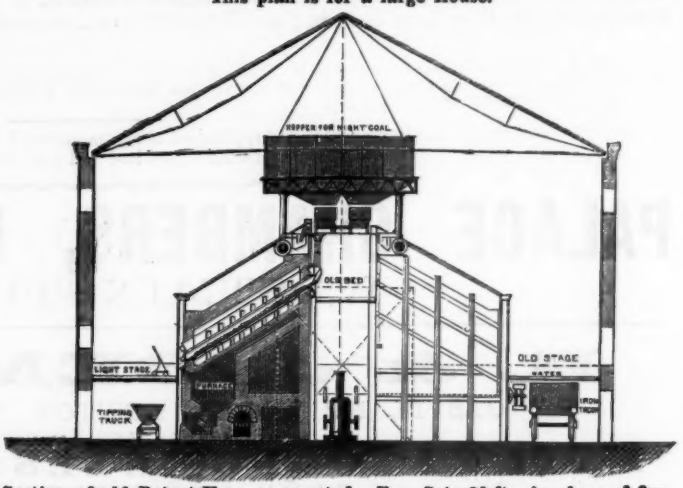


Section through Settings Back to Back.
Working off ground floor with Generator under Stage and Regenerator under the Sets.

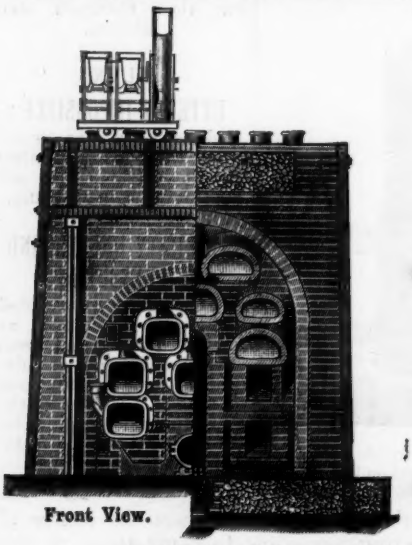


Transverse Section of House with Coze's Single Settings,
Showing Method of working Two Single Settings and Distributing the Coal to the Supply Hoppers; the whole of the work being Automatic.
This plan is for a large House.

Section through Middle Retort and Furnace.

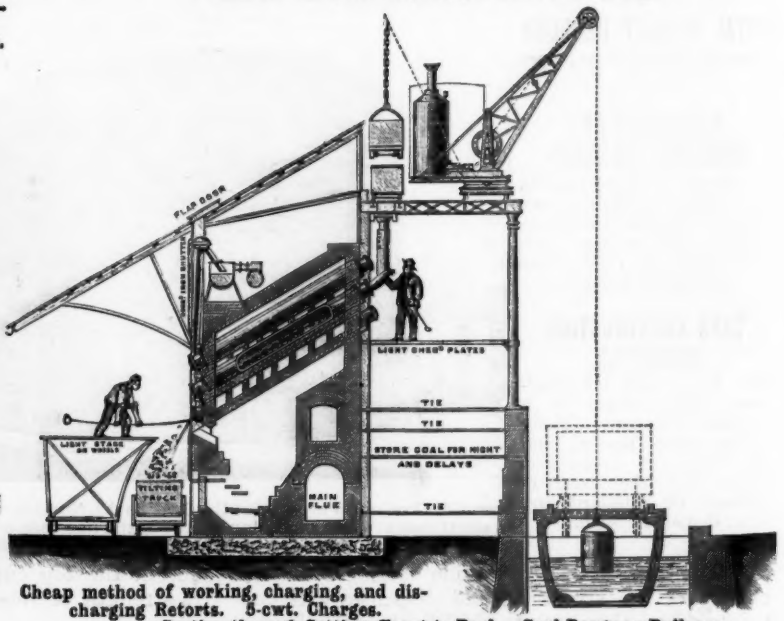


Section of old Retort-House converted, Two Sets 20 fts. in place of One.
Modified form, with ordinary Retorts and Fittings.



Front View.

Section through Furnace & Bed.



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W. & B. COWAN'S DRY METERS.

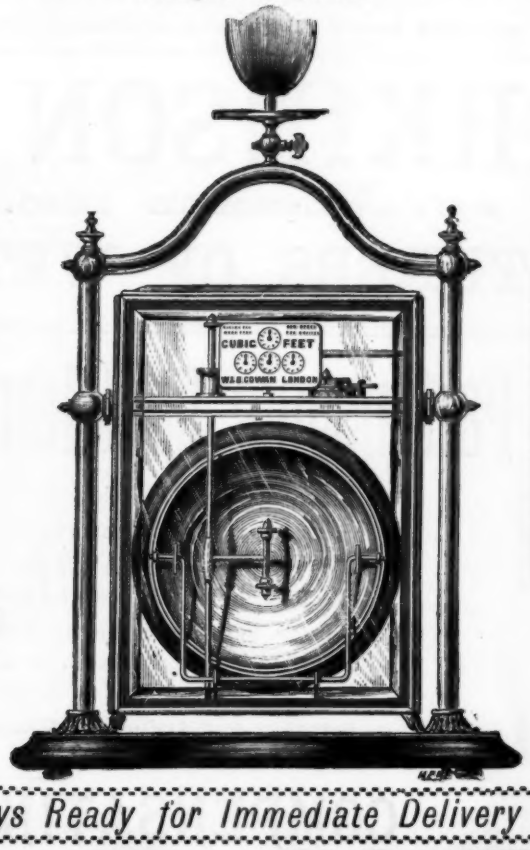
Outside Dimensions.

Size.	Depth, Back to Front.	Height, including Unions.	Width, including Unions.
Lights.	Inches.	Inches.	Inches.
2	7¼	13¾	10
3	8⅝	15	11¼
5	9½	16¾	13
10	10¾	19	15
20	13¼	24½	18½
30	16⅛	27½	21¼
50	20¼	33¼	26
60	21	33½	27
80	24¼	40½	31
100	25½	42¼	33¼
150	27¾	50¾	42
200	30	56¾	42¾
250	34¼	58	46¼
300	38¼	63¼	49¼
400	41¾	72¼	56¼
500	46	74	57½

150 Lights and upwards.

Measuring Capacity.

Size.	Bore of Inlet and Outlet.	Per Revolution.	Per Hour.
Lights.	Inches.	Cub. Ft.	Cub. Ft.
2	½	0·083	12
3	⅝	0·125	18
5	¾	0·160	30
10	1	0·3	60
20	1¼	0·5	120
30	1⅜	0·830	180
50	1½	1·428	300
60	1¾	1·6	360
80	2	2·5	480
100	2	2·857	600
150	3	5·0	900
200	3½	6·6	1200
250	3½	7·3	1500
300	4	8·3	1800
400	5	12·0	2400
500	5	14·285	3000



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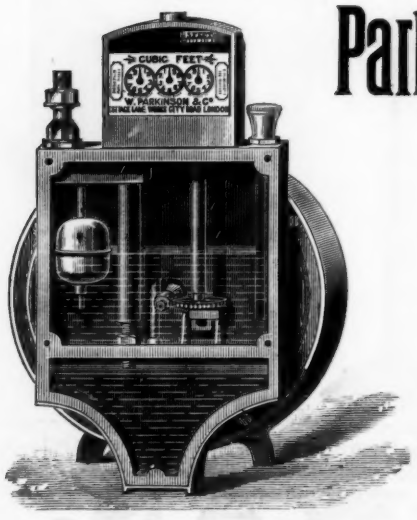

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See also Advt., p. 1173.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 2, 1890.

Professor Lewes on Gaseous Illuminants.

THE course of Cantor Lectures on "Gaseous Illuminants" now being given at the Society of Arts by Professor Vivian B. Lewes, the first of which is reported in the present issue of the JOURNAL, will be attentively studied by the very large class of people who, either as makers of gas or of gas-burners, are closely interested in this important subject. If the remainder come up to the standard of the first of the series, these lectures will greatly enhance Professor Lewes's already high reputation as a specialist. We hope to find much matter for discussion in his remarks from first to last; but for the present we desire to confine attention to his statements respecting the theory of the luminosity of flames. This is a matter that underlies all possible utilization of coal gas as an illuminant. It is true that the professors and lecturers upon any of the arts are not, as a rule, the men to advance their arts by new inventions. Their function is not to create, but to criticize—using the latter term in its widest and best sense. They follow up the inventors, and systematize their discoveries; thus making good the ground won by the skirmishers of the arts, and enabling successive relays of pioneers to penetrate, starting from safe bases, still farther into the Unknown. The essential difference between an inventor and a professor in the arts is also exhibited in the circumstance that the latter can teach, while the former can seldom do more than demonstrate. Neither can do much independently of the other. The inventor, as time goes on, has to lean more and more upon the critical teacher. The days of "lucky hits" by inventors without knowledge of the established principles of the art they attempt to improve are practically gone, if they ever existed out of the popular imagination. We believe, however, that the general idea of the way in which great inventions have been "hit upon" in past times, by a mental process akin to intuition in persons without previous experience of, or study in, the subject-matter of the invention, is largely an illusion. These triumphs come not save by striving and study, directed, of course, by an innate originating power. Nobody, moreover, ever heard a true discoverer despise learning. All his cry is, as a rule, for more information. He knows by experience the toil and waste of the method of "trial and error" by which he has to proceed after precise knowledge fails; and however successfully "self-taught" himself, he will lavish upon his children all the instruction he can procure. What the true inventor is impatient of is that kind of pedantry in theorizing which presumes to set bounds to discovery in any direction, merely because all beyond is dark to its own perception. He demands of criticism that it shall confine itself to its own province, and not limit enterprise except in directions which can be proved to be "no thoroughfares." The criticism that established the principle of the Conservation of Energy was fruitful, because it put a final stop to research after Perpetual Motion, and thus liberated much human effort for useful work. On the other hand, the pedantry that denied the possibility of steam locomotion on land and sea, that hindered the adoption of the screw propeller, that sneered at lightning-rods, and formally dismissed the regenerative principle as a means of increasing the luminosity of flames, is a mischievous thing, to be fought wherever found.

Every student of modern gas-lighting methods must have often been struck with the lapse of time that was permitted before the application of the regenerative principle to luminous flames followed the introduction of the same principle for heating purposes. The fact that keeping a gas-flame hot increases its luminosity is now so universally accepted, that it seems hardly credible that the British Association could have missed perceiving it only ten years ago, or nearly at the same time that Mr. Frederick Siemens was experimentally proving the truth. The British Association declared that heating gas and air up to the highest point consistent with the endurance of the apparatus for burning the former in the latter, made little or no difference to the power of the light. When Mr. Siemens was told of this result, he merely remarked that the British Association Committee had gone the wrong way to work. There never could be a neater illustration than this of the need of caution in assuming that a negative has been proved in science or art.

Now with regard to the cause of the luminosity of flames, the practical importance of a correct understanding in this matter is obvious, when it is borne in mind that, so far as present knowledge goes, there is no limit to the duty that can be obtained in the form of light from a given quantity of coal gas. Of course, there is a limit; but nobody can pretend to define it. We know that gas can be burnt so as not to give any light at all, or to give a variable amount of light, merely by alteration of the conditions under which air is permitted to operate in effecting its combustion. The extremes, which are in evidence always and everywhere, are the Bunsen and

Argand burners. Beyond the latter, nobody has yet been able to go; and it is well known that too sharp an air-blast, easily producible by an exaggerated chimney, damages the luminous effect of the gas-flame while heightening its whiteness—that is to say, its energy of combustion. When the air necessary for combustion is heated, as in the numerous varieties of regenerative lamps, the luminous duty is increased; and preliminary drying of the air and gas also improves it, for practically the same reason, since aqueous vapour has a considerable capacity for heat. Here again we come to a stand, for beyond desiccated gas and air in the best form of heat-recuperative lamp nobody has yet gone in the way of getting light out of coal gas. What is to be the nature of the next step is at present hidden in futurity. That there is room for advance seems to be indicated by the disclosures recently made by Professor Langley regarding the duty obtained by self-luminous insects, such as the fire-fly, from the matter they burn in the wondrous lamps perfected for them in Nature's laboratory. The fire-fly's light is due to combustion, just like that of the gas-flame; but to what different purpose does the insect consume its fuel, seeing that its light is attended with the emission of only 1-400th part of the heat of that of a standard candle, which is a little more wasteful than gas. If there is any value at all in this indication, it would appear that long before the economy of Nature in the matter of light is approached, coal gas would vastly transcend its present illuminating value. How is this advance to be made? First of all, undoubtedly, by taking account of all that is already known of the way in which gas-flames do their lighting; and for this information we must look to ingenious expounders like Professor Lewes.

We are not going to do Professor Lewes the disservice of discussing his views on this great subject piecemeal. Suffice it to say that he supports the Davy hypothesis, which ascribes the luminosity of flames to the incandescence of solid particles of carbon; and combats the Frankland hypothesis, which would account for the phenomenon by reference to pressure. How completely he succeeded in this line of advocacy may be matter of opinion; but we shall not say anything about it until at least the course of lectures is completed. A man can hold either view without incurring suspicion of heterodoxy, since it is not easy to settle a matter of this kind as plainly as a question of arithmetic. Meanwhile, the Society of Arts are to be thanked, in the name of the gas industry, for admitting the subject into their scheme of public lectures.

The Parliamentary Notices for Next Session.

In another part of the Journal will be found the notices that have been given in the *London Gazette* of intended applications to Parliament and the Board of Trade for Bills and Provisional Orders respectively, relating to lighting, for the ensuing session. The fact that Parliament happens to be sitting now does not, of course, affect Private Bill business, which will be transacted in the ordinary manner, and at the customary times. The most generally interesting Gas Bills will perhaps be those of the kindred Companies—The Gaslight and Coke and the Brentford—which seek the common object of correcting the doubts left by recent legal proceedings respecting the matter of cutting-off notices and procedure. It seems a remarkable thing that a bit of County Court experience respecting such a routine matter should have so deeply stirred these two Companies as to cause their simultaneous rush into Parliament, which will at least have the effect of concentrating public attention on one of the least popular aspects of the general law of gas supply. The law is, as we have said, of general application; and if it is defective, the correction ought to be made general also. The Partick, Hillhead, and Maryhill Company are in Parliament again, with unabated desire for incorporation with statutory powers; but this is the only Gas Bill that offers much prospect of a conflict. The session in respect of gas business will, in fact, be as dull as is now usual. A strange Bill of which notice has been given is that of Bowman's Oxygen Company, Limited, who want to be enabled to lay mains throughout the Metropolis for the supply of oxygen for a variety of purposes, among others for improving the illuminating power of the ordinary lighting gas sold by the Companies. This Bill, if it comes before the Committees, will raise many novel questions, and may give rise to some interesting debate. The Provisional Orders, as will be seen, promise to be neither numerous nor to affect any large undertakings, with the single exception of Salford.

The Manchester Institution Meeting.

The Manchester District Institution of Gas Engineers held their autumnal quarterly meeting on Saturday in Manchester, when a substantial and varied programme was gone through under the presidency of Mr. Walter W. Hutchinson, of Barnsley. Mr. Thomas Newbigging read a useful little paper on "Lime Burning," a knowledge of which art is indispensable to the gas manager in those localities where he has to do everything for himself. Mr. W. R. Chester, of Nottingham, read a paper on the use of steam in connection with regenerative retort-furnaces, and exhibited a drawing of a tubular boiler of his own design, for utilizing the waste heat of the main flue of a setting. This was a workmanlike and suggestive paper; and, although not fully discussed, it will be an interesting addition to the published Transactions of the Institution. A peculiar feature of the technical business which occupied the meeting was the appearance of Mr. W. Gadd as a lecturer on a particular aspect of his patent system of gasholder construction. This performance was described as a "physical demonstration" of the effects of wind pressure on a gasholder guided from the base; and it consisted mainly of some neat experiments with cards and weights. Unfortunately, a fragmentary look was imparted to the "demonstration" by the accompanying references to outside controversy, which was clearly the cause of Mr. Gadd's appearance before the Manchester gas managers, not one of whom has had anything to do with it. The disadvantage of carrying matter from a temporary controversy into a meeting of a technical society is, that it cannot be understood without presuming upon knowledge, on the part of the members, of the elements of the controversy, which may or may not be a safe assumption. But, however safe it may be at the time, controversies are shorter-lived than most technical societies like to think their own literature will be; and consequently the time comes, sooner or later, when any contribution to this literature which depends for its origin and most of its interest upon a dead *polémique*, appears to the student imperfect, one-sided, or out of place in a technical record. It is with no special application to the case of Mr. Gadd that we incline to the opinion that committees of technical societies would do well to eschew contributions arising out of current controversies. There is plenty of opportunity elsewhere for the ventilation of opposing opinions, without making a cock-pit of a professional gathering—a cock-pit, moreover, where only one contestant appears at a time, and does his crowing in the absence of the other bird. Mr. T. O. Paterson, of Birkenhead, was elected President of the Institution for the ensuing year.

Cheap Gas for Fires.

There has been a good deal of fog of late in the atmosphere of most British towns, and consequently the familiar outcry against smoke has been raised from end to end of the country. In Manchester—as foggy a city as there is in the world, not even London itself excepted—Mr. George E. Davis has just been lecturing on the subject in a very capable fashion; but all that he could do was to exhibit anew the apparent hopelessness of the case for smoke prevention. Mr. Davis recognized and emphasized the fact that it is the domestic fireplace which is the chief offender in this respect; and his remarks on this subject bristled with references to the antiquity, not only of the trouble itself, but also of the principal devices that have been proposed for removing or reducing it. The truth of the matter is that while considerations of cash and convenience impel the householder to burn smoky coal, no natural philosopher has arisen to show him how to burn smoky coal smokelessly. Gas coke, after all that can be done to increase its suitability for household use by breaking it into small and uniform-sized lumps, is not a favourite fuel for anything else than kitcheners and close stoves. The only present hope of the smoke abolitionists is coal gas; and there can be no doubt that this cleanly fuel will increase in popularity more and more as time goes on, not on account of its smokelessness—for as to this the average householder is indifferent—but because it saves much work in a house. Mr. Davis had a bitter

complaint to make of the neglect of the cause of "day gas" by the Corporations of Manchester and Salford; and he declared that coal gas, even at 2s. per 1000 cubic feet, is too dear for heating rooms in the ordinary way. We are not so sure of this; but, of course, the cause of smoke abatement would be immensely furthered if a suitable gaseous fuel could be had for 1s. per 1000 cubic feet, which he seems to think could be supplied in Manchester by a special company. This is a chimera; and the Corporation would undoubtedly be justified in opposing to the last extremity a project to launch such a company in their midst. We do not look for any public-spirited action in gas matters from the Manchester Corporation; but it would be an interesting experiment if some Corporation like (say) that of Ramsgate, which is not hide-bound, would make a start with the supply of gas for fires and heating-stoves at half price, or any figure that would attract this class of consumption.

Domestic Refuse.

A CURIOUS case that recently came before the Court of Appeal under the style of *The St. Martin's Vestry v. Gordon* is not without interest for suppliers and users of gas for power and other trade purposes. It was the sequel to proceedings originated in a Police Court, upon the question whether or not the Vestry were bound by law to remove in the ordinary course the clinkers and other refuse of the furnaces of boilers erected in the Hôtel Métropole for the purpose of supplying electric lighting for the hotel, heating the public rooms, and cooking. The Vestry contended that the clinkers, &c., were the "refuse of a trade" within the meaning of the Act, and therefore that they were not bound to remove them without payment. This contention was denied by the hotel proprietor. The Magistrate stated a case for the opinion of a Divisional Court on the point, and the decision was adverse to the Vestry; whereupon they appealed. There was some difficulty, as usual, in interpreting the Act of Parliament governing the matter, in consequence of certain inconsistencies in the language of different clauses; but, in the event, the Lords Justices of Appeal agreed that the refuse in this case was not properly describable as trade refuse. Residues of fuel consumed on premises for lighting, heating, or cooking were distinguished by the Court from refuse left from a manufacturing process, to which it was held that the terms of the Act applied. Thus, tinplate scrap is trade refuse in a sense in which clinkers from steam-boilers employed for a domestic purpose is not; although it may be supposed that clinkers from furnaces used in making steam for a tinware factory would be trade refuse. The domestic furnaces of a large hotel may make more refuse than would be produced by the fires of a private residence occupying the same spot; but the Court made it clear that the quantity involved would be immaterial to the issue. Henceforth, therefore, the Hôtel Métropole, and other similar establishments equipped in the same way, will be able to have their furnace dirt removed without extra charge. This is a larger question than it appears at first sight, because it is well known that the popularity of gas-engines for town use is largely enhanced by the fact that they do not produce any ashes to be removed, sometimes at considerable expense. It would be a really serious matter for local sanitary authorities if the judgment of the Court of Appeal in the case under notice were to be misunderstood. It cannot be too plainly stated, therefore, that this interpretation of the law applies only to hotels, and to refuse from furnaces used for domestic or *quasi*-domestic purposes. All others remain unaffected by it.

Automatic Hot Water Supply in Paris.—A further development of the automatic supply system has taken place in Paris; some of the streets being provided with kiosks fitted with appliances for furnishing a supply of hot water on a coin being dropped into a receptacle. In order to bring the apparatus into use, a pail is placed in a suitable position, a 5c. piece (equivalent in size and value to a halfpenny) is dropped into a slot, and a button pressed; whereupon a jet of steaming hot water issues, and continues flowing until about two gallons have been delivered, when it stops. Curiosity may possibly be excited as to the method of keeping the water hot. This is very simple. The interior of the kiosk is partly occupied by a coil of pipe, within which is a gas-burner, for heating water rapidly. The coil communicates with the water service; so that the water drawn is always fresh. The gas is not wasted by being kept constantly burning, but is lighted by the pressing of the button, which also opens the faucet.

WATER AND SANITARY AFFAIRS.

THE London Water Bill, prepared by Mr. Blundell Maple, has passed into the hands of Mr. Gainsford Bruce, and has been read the first time in the House of Commons. This Bill is "to provide for the supply by meter of water for domestic purposes within the limits of supply of the London Water Companies." Such at least is the professed object of the Bill according to the text now issued. But this phraseology does not correctly describe the character of the measure. If it were a Bill requiring that henceforth all the domestic water supply in the districts of the London Water Companies should be furnished and paid for by meter, it would possess an element of consistency which at present does not belong to it, and would be at the same time less unjust. This supply by meter is not to be compulsory, but optional; the consumer being empowered to demand, while the Companies are to have no power to initiate it. The effect of such an arrangement is obvious. The option will always be exercised to the prejudice of the Companies. The consumer will calculate which plan will best suit his pocket—to pay for his domestic supply according to the rateable value of his premises, or according to the quantity consumed as indicated by a meter. Of course, he will choose that method which costs him least. Where the consumption is small, the meter will be demanded. Where the quantity of water consumed is such that, if measured out at so much per thousand gallons, it would vastly increase the charge, the consumer will rest content, and will say nothing about a meter. We would ask, in the first place, whether this is anything like what is commonly called "business;" and, in the next place, whether it is anything like equity? To make the matter worse, there is no minimum charge specified. Where the quantity of water consumed in any quarter does not exceed 200,000 gallons, the charge is not to exceed 9d. per 1000 gallons, let the quantity be never so small. Supposing this scale to be legalized, there would be held out to the great majority of householders a strong inducement to cut down their use of water to the lowest possible point. Every 1000 gallons in the way of reduction would be a gain of 9d. to the consumer. The average supply for domestic purposes is at present a little more than 16,000 gallons per quarter for each house. This is far below 200,000 gallons, but would soon shrink to still lower proportions under the proposed law, and the loss to the Companies would be immense; while habits of cleanliness would be directly discouraged, and the sanitary state of the Metropolis placed in peril. A large amount of City property, including warehouses and offices, would escape payment of its proper quota; while the Companies would still be expected to furnish a cataract of water in order to extinguish the flames when some huge mercantile edifice happened to be on fire. A supply by meter, at the option of the consumer, means an utter derangement of the Metropolitan Water Supply, and would never be entertained by any responsible public authority possessing the undertakings now owned by the Water Companies. Supposing the Corporation to anticipate that they shall succeed in getting water by means of deep wells, do they contemplate supplying this by meter, when required to do so by the consumer, at the rate of 9d. per 1000 gallons? The Bill proposes as little as 6d. per 1000 gallons where the supply per quarter exceeds 200,000 gallons. But let the tariff be settled as it may, the entire proposal is radically bad, and altogether at variance with sanitary principles. In fact, this so-called "London Water Bill" is simply a scheme for supplying water "dirt cheap." In the end, we doubt whether even cheapness would be secured. But of the unwholesome results there need be no doubt.

Mr. Causton's Bill, which like that brought in by Mr. Bruce, has been read the first time, is designed to regulate the charges leviable by Companies supplying water within the Administrative County of London. We may suppose it is on the same lines as the Water Companies' Charges Bill, introduced by the same member last summer, in which it was proposed to prevent any increase in the charge for water in consequence of the forthcoming quinquennial valuation. If the Bill provided that there should be no reduction in the charge in virtue of a falling off in the valuation, the Companies might hail the measure with some satisfaction. But like all these schemes for modifying the terms of the water supply, it is essentially of a

one-sided character, such as would never be tolerated if the water supply were public property. It is to be observed that Mr. Blundell Maple's Bill, if passed into law, is to come into operation on March 25 next year. We may expect that the same is intended with regard to Mr. Causton's measure. The new valuation begins to operate on April 6. Whatever the real design of these Bills, they will evidently serve not only to anticipate that date, but to strike a blow at the London Water Companies prior to the action of Parliament with regard to the two Bills of the Corporation and the Vestries. The circumstance that the parliamentary session commences in the autumn of the present year, facilitates the attack on the Water Companies. Bills affecting their revenue have a possible chance of becoming law early in 1891; while Bills for the transfer of the supply will come on later. But these latter measures may encounter a difficulty in the shape of an early dissolution, brought on by the Government. We cannot really believe, whatever chances are given, that such Bills as those introduced by Mr. Bruce and Mr. Causton will receive legislative sanction. The other Bills are exceedingly likely to be hung up by the coming of a general election. Altogether, the parliamentary prospect is a very disturbed one; and on this account there is the less probability of any legislation on so weighty and complicated a question as the water supply of the Metropolis. A little insight into the tactics of the County Council has been afforded within the last few days. A member of that body moved—"that it be an instruction to "the Water Supply and Markets Committee to inquire "and report as to the practicability, advisability, and prob-"able cost of providing an independent and competing "supply of water for the use of the Metropolis." The mover was thereupon told that "the Committee were "already doing" that which he proposed. The idea of "an independent and competing supply" is thus entertained; and yet the County Council have professed a desire to "negotiate" with the Water Companies concerning the price at which their undertakings are to be acquired. This notion of a competing supply stands in the way of another proposal on the part of the County Council—namely, that Mr. Binnie, their Engineer, shall be permitted to "examine the works" of the several Companies. Is this fair or reasonable, when the Council are working in antagonism to the bodies whom they so approach? Mr. Binnie is an eminent Engineer, especially as concerns the water supply of towns, and is an honourable man. But what use will the County Council make of the information he may obtain from the proposed inspection? Under the circumstances that present themselves, the Companies will be justified in shutting their gates, if they choose to do so.

The list of parliamentary notices for next session is now complete. We mentioned on a previous occasion the Bill of which the Croydon Corporation have given notice concerning the district of the Lambeth Water Company. The Hendon Local Board seek power to enter into arrangements with the West Middlesex and Colne Valley Water Companies, so as to obtain an additional and constant supply for the Hendon district. Among the provincial Bills of which notice has been given, there is one by the Sunderland and South Shields Water Company, for power to execute new works on a considerable scale. The Manchester Corporation wish to be authorized to supply hydraulic power. A new Water Company is proposed for Market Drayton, and one for the Western Valleys in Monmouthshire. The Duke of Portland gives notice of a Bill for the better supply of Troon with water. The Dundee Water Commissioners propose new works; and the Malvern Local Board intend applying for power to construct water-works and supply water both within and beyond their district. The Matlock Water-Works Company, Limited, desire to increase their capital so as to provide for the adequate supply of their district. The Newark Corporation seek to acquire the undertaking of the local Water Company, and give notice of a Bill for the purpose. Particulars of other Water Bills will be found in another part of our columns; but it will be seen that there is no project of striking magnitude. In several instances there is a proposal for an extension of limits.

Death of Mrs. Wright.—We regret to have to record the death, on the 24th ult., at the age of 66, of Mrs. Harriet Augusta Wright, widow of the late Alexander Wright, of Westminster.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1137.)

THE process of the restoration of confidence, the remarkably rapid strides of which we remarked upon last week, has gone on gaily without a check. The panic is almost ancient history, the bears are extinct animals, and bulls abound. All this is a very comfortable contrast; but it is to be hoped that it will not be overdone. The rise in the prices will naturally be subject to temporary checks, as those who got in at low figures will take their profits. But nevertheless there is every reason to expect a good solid advance, and one that ought to be fairly permanent. The Money Market is easy, and is likely to be easier. Rates for deposits have been lowered; and the discount rate will not improbably be reduced this week. The Gas Market continues steady; and as little moved by the general advance in prices elsewhere as it was by the recent depression. Business was moderate in the earlier portion of the week; but for the remainder, it tailed off very quiet. The Metropolitan stocks are wholly without change. Gaslight "A" has been evenly done between 236 and 238, which are about the same figures as those commanded for some weeks past. On Wednesday, a fair amount of business took place in debenture and preference issues at average prices. South Metropolitans have been relieved from stagnation by two or three transactions in "B" and "C;" and Commercial has been similarly saved by a little business in old stock. Neither presents any noteworthy feature. Of the Suburban and Provincial Companies, none has been dealt in but British; and the prices realized were but poor. Greater activity was to be found among the Foreign undertakings. Of the Continental group, Imperial Continental has been in good demand; and the price has advanced sharply. On Monday business was done at 216½; but the closing transaction on Saturday was done at 220¾. In Continental Unions the discrepancy between the fully-paid and the £14 paid shares has been corrected by an advance of 1 in the former, and a reduction of 1 in the latter. Of the rest, San Paulo is noticeably in continued favour, and fetched top price on Tuesday. There has been a little more activity among the Water Companies. Prices generally are firm; and Chelsea and West Middlesex are higher. Southwark and Vauxhall, however, which frequently sails on the opposite tack to the rest, has receded something like 1 to 3 per cent.

The daily operations were: The opening on Monday showed no marked disposition either way; and prices ruled about an average. The only change was a drop of 1 in Continental Union £14 paid. Small business was done in Water; Southwark ordinary falling back 1. On Tuesday, Gas showed out firm, especially for the new account; and Gaslight "A," Imperial Continental, and San Paulo fetched top prices. In Water, Southwark was again offered. Firmness characterized Gas on Wednesday; and Imperial Continental rose 1. Bahia fell 1. Thursday's business was very restricted; but Imperial Continental advanced 1 more. In Water, Chelsea and West Middlesex changed hands at good figures. The former rose 1; and the latter rose 2. Southwark "D" shares fell 3. Friday was equally quiet, and was noticeable only for another advance of 1 in Imperial Continental. Saturday's Gas business was very limited; and nothing at all was done in Water. All quotations remained unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Affairs of the Swan Company—The Fire at the Grosvenor Gallery Electric Light Station—The Standard of Street Lighting.

THE eighth ordinary general meeting of the Swan United Electric Light Company was held on Tuesday last, and may be regarded as the event of the week in electric lighting circles. Mr. James Staats Forbes presided, and explained in some detail the peculiar composition of the Company, which is distinctly complicated—the result of a good many amalgamations and "arrangements," pacific and otherwise. There is shown in the Company's accounts a profit balance of £44,477, out of which the Directors recommended the payment of a dividend after the rate of 10 per cent. for the past year, which practically represents the whole of the profit made. Of course, this proposal pleased the shareholders; and the dividend was declared accordingly. At the same time, the ability to pay a 10 per cent. dividend is not everything; and it is by no means certain that the Directors might not have done better if they had wiped a little more off the valuation of the Company's patents, which stand at a preposterous figure. It is true that this particular Company have done very fairly by their patents, which have been upheld in the Courts, and have therefore conferred upon them the monopoly of the incandescent lamp trade. If there is money in the electric lighting connection for anybody, it should be for them; for they run no risks, and supply an article which everybody must have. Mr. Forbes admitted, in his speech to the shareholders, that the Directors know that their period of protected trading is running out; and he claimed that the Company are building up such a business that when the patents expire nobody will be able to compete with them on level terms. This will only

be the case, however, if the inflated capital of the Company is reduced in time; for otherwise, when the lamp manufacture is thrown open, the Company will be seriously handicapped in the competition with rivals who will have no patents to pay for.

There was recently a fire at the Grosvenor Gallery electric lighting station, which resulted in the temporary suspension of the service for that particular district. This is not the first time that trouble has been experienced at this station; and accordingly the newspapers have commented upon the incident in a way that has considerably irritated the electricians connected with the undertaking, who have supplied to an engineering contemporary what purports to be a full, true, and particular account of the origin of the disaster. In this story it is stated that the affair had something to do with the conversion of the Grosvenor Gallery station into a distributing centre for current supplied from Deptford. A man was putting in a plug switch to connect up a new set of converters, when sparking occurred, and frightened him into pulling out the plug again, whereupon an arc formed between the main and the switch, and soon set fire to everything in the place. Of course, the man might have done all manner of things to prevent the mischief, but equally of course he did nothing but call in a helpless way for assistance. This is the official tale; that of the man implicated has not been published. Meanwhile, there are so many morals to the story, that we prefer to leave our readers to draw them for themselves. The general public notice these things, and come to conclusions that not all the plausible explanations of electricians can shake. The plain fact that an electric lighting company's own place was burnt out in about 20 minutes, causing a loss of from £15,000 to £20,000, and all by a very ordinary action on the part of a presumably experienced attendant, will, in the eyes of the public, display in a very lurid light the system liable to such accidents.

In a recent discussion in the Bath Town Council upon the local electric lighting, a curious indication appeared of the manner in which intelligent public opinion compares the two most familiar means of lighting streets. A town councillor remarked that the new lighting in Bath was an immense improvement upon the old gas-lamps, in proof of which assertion he mentioned that "a threepenny piece placed on the pavement between two of the electric standards could be seen easily, whereas it was impossible to detect a similar coin placed on the pavement between two gas-lamps." There is something very funny about this sort of photometry. The imagination expands pleasantly over the idea of a town councillor wandering through the streets of Bath, dropping threepenny pieces on his way, and, of course, abandoning to wayfarers with keener eyes than his own those that he could not see to retrieve. One cannot help wondering, however, whether it really is a fair standard for street lighting, which is paid for out of the rates, that an elderly gentleman on the Town Council should be able to see threepenny pieces anywhere in the roadway at night. If it is a proper test—in regard to which we, for the present, have no opinion to offer—the next question would surely be as to the cost at which such a test might be satisfied. We know perfectly well that it must cost a good many threepences spent upon electric lighting to enable a single one to be picked up by the light; and if it came to that, it is only a question of how many threepences a gas company would demand as consideration for working up to the novel standard. On the whole, it is to be feared the proposed threepenny-piece test will hardly answer. People do not, as a rule, use streets either for strewing small silver in or for hunting for it, except in accidental cases; and the standard of lighting must therefore be sought with reference to the ordinary needs of wayfarers. It used sometimes to be urged on behalf of electric arc lamps, when they were first introduced for street lighting, that one could read the small print of a newspaper by their aid. But this plea invited the retort that nobody wants to do anything of the kind out of doors; and therefore to provide such superfluous lighting in the streets, at enormous expense, would be an absurdity. The true standard of sufficiency in street lighting, beyond which extravagance commences, varies in different places mainly according to the amount of traffic; but, while difficult to define, it is easy to realize. Lighting which enables foot passengers to make their way quickly and safely along side walks, and especially to cross roadways with fair assurance of security, is good enough for its purpose.

Restriction of the Use of Natural Gas at Pittsburgh.—Considerable excitement has, says *Industries*, been produced among the iron and steel men of Pittsburgh by the announcement of the Philadelphia Gas Company that hereafter no puddling furnaces in the city or its vicinity are to receive natural gas as fuel. As there are about 1000 furnaces in the city, more than one-half of which have been using natural gas as fuel, a very large expenditure will be necessary to again fit them for coal; and a heavy increase in expenses will follow, as coal is high and the contracts for natural gas have been at very low rates. At the opening of the present year, in addition to manufacturing establishments of all kinds, the Company supplied 24,000 houses, and the consumption was 500 million cubic feet daily. The Company say that they have now more gas than ever, but that the demand from their valuable source of income —the private residences—is also greater. The Company have decided to undertake the supply of illuminating gas.

THE NEW WORKS AT KENSAL GREEN.

THE continuous expansion of London has been the cause of many developments in gas-works construction and polity. It is notorious that a Bishop of London was responsible for the well-known Imperial type of retort-settings of tens, in five superposed pairs, because, as a landowner of Fulham, he sucessfully opposed the extension of the gas-works in this locality; thereby compelling the engineers to carry their retorts "upstairs," when they wanted more producing power to cope with the increase of consumption. The growth of London was the fundamental cause of the obliteration of the City of London Gas Company, and the removal to Beckton of the gas-works for the supply of the city itself; and this change, again, facilitated amalgamation. For many years the necessity of finding work for Beckton dominated the policy of The Gaslight and Coke Company. A mistake was made in overbuilding this station; and it took all the extension of gas consumption in the whole of London for some years to fairly occupy the huge establishment that had been set up in the Essex Marshes. Meanwhile, all the other stations merely "marked time," as the military phrase goes, and were in a sense sacrificed to Beckton. There was good reason for this in the superior economy of Beckton as a manufacturing station—an advantage which it owes entirely to the facility that exists there for putting coal directly from the steam-colliers into the retorts. Apart from its geographical situation and its power jetty, however, Beckton could not be regarded as particularly well laid out for economical working, judged from the modern standpoint. It was a considerable advance upon the older gas-works, situated, like Fulham and Bromley, in localities that could only be reached by transhipped coal. But its mechanical appliances for handling coal were confined to its jetty; and the moment coal had to be stored instead of placed upon the stages for immediate consumption, it was no better off than other works built on a less pretentious scale.

Beckton has now become pretty well filled up, however, and will henceforth have as much as it can do in supplying the eastern and central portions of The Gaslight and Coke Company's district. The ceaseless growth of London towards the north-west and west cannot any longer be supplied with gas from an Essex station; and the first of the older stations to be awakened into fresh life is that at Kensal Green, once the head-quarters of the Western Gas Company. The Gaslight and Coke Company have for years had land suitable for the enlargement of this station, which adjoins the Great Western Railway, nearly opposite to Wormwood Scrubs; but no extensions had been done here for a long time till about a year ago, when the Directors decided that the producing power of the works, ordinarily rated at upwards of 4 million cubic feet of gas per day, should be doubled, by the construction on the available land of an entirely new and complete manufacturing plant of this capacity. The additional supply was wanted at the earliest possible moment; and so Mr. G. C. Trewby, the Company's Chief Engineer, with the assistance of Mr. Arthur M'Minn, the Engineer in charge of the station, put the new work in hand at once.

All the contracts are now in a forward state; and a visit to the works shows how busy the Engineers must have been to get a 4 to 5 million works so nearly completed within the stated time. The retort-house and coal-stores (without the retort-setting) and the canal dock were constructed in 1882 by Messrs. J. Aird and Sons from Mr. A. M'Minn's designs; so that the first part of the new work to be taken in hand was the arrangement for unloading the coal, which will be brought into the dock in barges. The new retort-house is placed end-on to this dock; and the barges will lie underneath two steam-cranes, which stand on the ground level, and will discharge the coal by means of "grabs." This is the same means of discharging coal that is actually in use for the present retort-house, where it last season proved itself a radical cure for the presumptiveness of the Coal Porters' Union, who wanted as much for discharging the shallow barges as they could get for breaking bulk in colliers in the river. The introduction of the grabs reduced the cost of unloading the coal barges from 4d. to 0·6d. per ton. The hoisting plant is being erected by Mr. Thos. Smith, of Rodley, and the grabs by the Thames Iron-Works and Shipbuilding Company. The grabs will empty upon converging screens, through which all the small coal will at once fall into a conveyor, and be taken to a pit where an elevator works; while the lumps will be collected, and will drop into a breaker, which will discharge into the same conveyor. From this pit the coal will be raised to the level of the conveyors, which run in three lines longitudinally through the retort-house. The middle conveyor, which is of the push-plate variety, is for the supply of the large hoppers fixed above the retort-bench, which deliver as required into the Coze charging-waggons. The other two conveyors, one on each side, command the coal-stores, which, as is usual, run on either side of the retort-house. At any time the stream of coal can be diverted from the elevator to one of these conveyor lines. Underneath each side coal-store again is a tunnel, in which a low-level conveyor works, and takes the coal from any part of the store to an elevator which lifts it to the high-level distributing plant already described. The whole of the coal-handling machinery, which appears to be very complete, is driven by a pair of 120-horse power Galloway steam-

engines situated in houses one on each side of the retort-house. Either engine could drive the machinery by itself, and is capable of being connected up for this purpose at a moment's notice. The idea at present is to work from the barges by day, and from the coal-stores at night, so that the stock, which is calculated to be equal to nearly a month's consumption, shall not grow too stale, and no unloading of coal by night will be necessary. The stores are separated by transverse walls into independent cells containing between 200 and 300 tons apiece, with a view to localizing spontaneous combustion. It will be observed that this method of emptying coal-stores is a great improvement on that obtaining in most gas-works, where, if stores are filled by machinery, they are often left without appliances for getting the coal out of them. All this coal-moving plant is being supplied by the New Conveyor Company.

The coal-carbonizing plant, as will have been gathered from a remark already made, is after the Coze system. There are in the one house 68 settings of sevens, or 476 retorts in all, 12 feet long, set back to back, and estimated to be capable of carbonizing a charge of 400 lbs. of coal every six hours. This it will be seen means a gross carbonizing capacity of nearly 400 tons of coal per diem. The retorts will be heated by simple regenerative furnaces of Mr. M'Minn's design. His present furnaces are simple generators; but in the new house the convenience of a low-level main flue will be utilized for regeneration in a moderate way. The retort-house itself is a handsome stage building, with cupola ventilators and a central and two end shafts. It is a piece of good brickwork, without any superfluity of ornament.

The purifier-house runs parallel with the retort-house, but with plenty of space between, which is partly utilized by tar-tanks and by the boiler-shed, containing three of Adamson's Lancashire boilers, which will be fired with breeze, and will supply all the steam for the new works. The purifier-house has two storeys above the ground; the lime floor being the uppermost, the boxes themselves coming next, and then the ground floor being left clear for emptying the vessels direct from the bottom by canvas shoots into covered side tip trucks, which are run on ordinary gauge lines, and tipped into barges in the dock; and for revivifying oxide, &c., when the upper storey is not available. The lime will be hoisted out of railway trucks by cranes; and when slaked it will run down to the boxes by means of canvas shoots. There are twelve 33 feet square boxes, with 30-inch connections, all made by Messrs. Newton, Chambers, and Co., Limited. They will be worked after the air process elaborated by Mr. A. M'Minn in conjunction with his brother, the late Superintendent of the Fulham works. The purifier-house is a strong and airy structure; the upper floors being supported on steel built columns. The lime floor is upon Hobson's system of deeply corrugated iron plates filled in level with concrete on the upper side. The exhauster-house is near by. It contains two of Donkin's improved exhausters, to be driven by single-cylinder steam-engines after this firm's well-known pattern. All the structural ironwork and fittings of this part of the plant is by Messrs. Ashmore, Benson, Pease, and Co., Limited. Alongside the exhauster-house are two of Kirkham, Hulett, and Chandler's washers, each of 2½ million cubic feet capacity. The condenser is merely of the ordinary horizontal type, and is being put together by the employees of the Company themselves.

It may be remarked that the above-described plant has been laid out with a view to convenience in case of future extensions; space, &c., being provided for additional plant of equal capacity to that now in course of execution.

A very important work now in progress is the concrete tank, 250 feet in diameter and 55 feet deep, intended for the reception of a three-lift gasholder of 7½ million cubic feet capacity. The tank is being made by Messrs. Lucas, Aird, and Ellis; and the holder by Messrs. S. Cutler and Sons. The site of the tank is in the stiff clay of the district, which will underlie it to a considerable depth, and remove all solicitude as to leakage. Near the intended holder is a Parkinson three-partition drum station meter. All these various works are being actively carried on; and the station consequently affords a very interesting and uncommon sight to a visitor of a technical turn. It is hoped that gas making may be started early in the new year; but, as everything has to be first completed, it is possible that one contractor may be hindered by another. The tank will almost certainly be finished this year, leaving next season clear for the erection of the holder. When all the work is done, The Gaslight and Coke Company ought to be in a position to be congratulated on the possession of the very newest complete gas-manufacturing station in the country, designed, constructed, and fitted in the very best and most improved style for making good gas at the lowest possible cost.

The Bradford Water-Works Engineership.—The Bradford Water-Works Committee have received 61 applications for the vacant post of Engineer, to which a salary of £1000 a year is fixed. The Committee have reduced this number to four, from whom a final selection will be made. The four candidates are: Mr. William Fox, of London; Mr. W. Watts, Engineer to the Oldham Corporation; Mr. James Watson, Engineer to the Dundee Water Commissioners; and Mr. R. S. Wyld, of Oswestry, Resident Engineer to the Liverpool Corporation in connection with the Vyrnwy scheme.

NOTES.

The Donkin "Revealer."

M. Dwelshauvers-Dery has submitted to the Industrial Society of Mulhouse a memoir on the Donkin "revealer" as applied to the demonstration of the behaviour of the interior surfaces of steam-engine cylinders while working. The author observes that it is hardly 15 years since the question of the thermic action of the exposed surfaces took an important place in the consideration of steam engineers. It was the late M. Hirn who did most to prove the importance of studying this question, and gave the practical theory elucidating the greatness of the exchanges of heat-units between steam and metal for the different divisions of every complete revolution. For 22 years, says the author, Mr. Bryan Donkin has had the ambition of being able to demonstrate experimentally and visibly the facts which the genius of Hirn had divined and appreciated. The first "revealer" which was made for this purpose consisted of a simple glass pressure-tube, closed at one end by a cock, and screwed at the other on the indicator connection. This arrangement therefore constituted a transparent prolongation of the surface in contact with the steam; and clearly exhibited the phenomena of condensation during the period of admission, and re-evaporation—partial during the expansion, and complete during condensation or exhaust. But this thin glass tube was open to various objections, and was modified in several ways, until in February of last year it received a new form suitable for calorimetric measurements. Mr. Donkin has settled more than one disputed point by the aid of this instrument, with which he is still experimenting. Among other things, it is hoped that the problem of the most economical temperature to accompany a given diagram may be ascertained. The instrument has not yet been used to any definite purpose in the exploration of the gas-engine; but this may be attempted in due course.

The Effect of Water on Overheated Boiler-Flues.

Mr. Lavington E. Fletcher has been engaged for some time, under the auspices of the Manchester Steam Users' Association, in disproving, by direct experiment, the traditional fallacy that turning on the feed to a steam-boiler that had become overheated through shortness of water would result in a disastrous explosion. It is the tradition that if water is allowed to touch the plates of a furnace flue which have perhaps become red hot, it will flash into steam with such violence that the safety-valve will be unable to relieve the boiler, and a tremendous explosion must ensue. Perhaps there is no superstition more firmly rooted than this in the mind of the average steam user. The first attempts at shaking this belief were made so long ago as 1867, after calculation had demonstrated that, owing to the low specific heat of iron and the small weight of the metal that could possibly become overheated in a boiler, it was simply impossible for any large quantity of steam to be generated from water brought into contact with even a red-hot flue. Lately, however, Mr. Fletcher's Association have been experimenting with a Lancashire boiler, the flues of which were not stayed against collapse in any way, but were plainly built of 7-16ths inch plates. The feed entered through dispersion pipes, which scattered it directly on top of the flues. The first experiment in overheating the flues was made at atmospheric pressure. The water was drawn down 16 inches below the crown of the tubes, and while the fire was burning very clear and bright, with both safety-valves closed, the pressure rose to 27 lbs. per square inch in three-quarters of a minute, after which it gradually fell, and in 13½ minutes had been reduced to 6 lbs. without anything being drawn from the boiler. The furnace plates were, of course, damaged. Further experiments, conducted under pressure, showed that the steam pressure commenced to fall when the feed was turned on, and that the danger is not, as commonly supposed, in turning on feed water to a boiler with an overheated crown, but in the risk of the crown collapsing through weakness of the iron when in this state—a risk which is increased by the act of drawing the fires, the usual remedy followed in such cases. In performing this operation, the stoker stands in the most dangerous position, and as, by stirring up the contents of the furnace, he for the time being increases the temperature, he is very likely to bring about the catastrophe which he seeks to avert, and in this event he must himself fall the first victim. *Engineering* thinks that Mr. Fletcher has now succeeded by these experiments in laying a mischievous bogey of the steam user and boiler fireman.

High-Power Oil-Lamps.

Nothing has more interfered with the utilization of the electric arc light in building and engineering work, on wharves, &c., and for rough outdoor purposes generally, than the development of the Lucigen type of lamps burning cheap tar and other oils. Experience on the Forth Bridge works demonstrated the wastefulness of electric arc lighting for such purposes; many more lamps being needed than would otherwise be required in consequence of the sharpness of the shadows thrown by single lamps. These high-power compressed-air oil-lamps have, like gas-flames, the power of diffusing their light over a wide area; they are not too dazzling to look at; and a single lamp is as efficient and economical as a number. Almost every

week fresh patterns of this class of lamp are brought out; the latest being that of Messrs. G. Rose and Co., of Anderston, Glasgow. It is claimed for this lamp that it will run for ten hours at its maximum luminosity without attention; also that it is self-regulating, and can be refilled without extinction, while the light can be graduated from 500 to 4000 candle power. It would be interesting if somebody would undertake a critical examination of lamps of this type, and compare them with gas "flares" and electric arc lamps.

COMMUNICATED ARTICLE.

THE CHEMISTRY OF ILLUMINATING GAS.

By Norton H. Humphrys, Assoc. M. Inst. C.E., F.C.S.

XLVIII.

CONDENSATION (*continued*).

Before going further, it will be well to form some idea as to the nature of tar. It is a very complex liquid, containing many different substances. There is not much use, however, in giving a table showing each and every constituent that has been detected therein, because the majority of the substances named are only present in infinitesimal quantity. Many of the so-called constituents are not separated until after repeated distillation; and it is possible that the action of heat may have some effect in determining the formation of certain constituents, and that the violent reactions that result from the application of a high degree of heat to the coal in the first place may be repeated, though in a more limited degree, under the less searching influences of the heat necessary for fractional distillation. The following table, extracted from "Lunge on Coal Tar and Ammonia," shows the indefinite nature of the published information as to the composition of tar. This is due to the fact that the practice differs at various distilleries, with regard to the temperature at which the products of the first distillation of crude tar are separated one from the other.

Source.	Ammonia Water, &c.	Light Oils.	Naphthalene.	Creosote Oils.	Anthracene Oils	Pitch.
Berlin Gas-Works .	15·20	1·90	3·70	24·00	..	55·00
London do. .	7·38	3·00	..	14·16	14·00	60·00
Do. do. .	4·00	3·28	..	15·70	18·83	56·29
Lancashire do. (mostly from cannel) . .	2·20	12·80	..	7·60	16·90	60·50
German coal tar . .		5 to 8	..	25 to 30	8 to 10	50 to 55
Boiling-point .	Under 220°	Under 400°	Under 450°	Under 540°	Over 540°	..

"Light oil," "creosote oil," &c., are therefore rather indefinite terms, and mean different things in different places. But we may take it that ordinary tar, obtained from bituminous coal in the usual way of working, yields from 3 to 5 per cent of products boiling under 400° Fahr., exclusive of the water and soluble impurities. The latter are in no sense a part of the tar, but are simply due to the ineffectual separation of ammoniacal liquor therefrom. Next there is the naphthalene, which, according to some researches by Mr. Watson Smith,* ranges from 2½ to 6 per cent. of the tar. Then come the creosote oils, boiling at 400° to 540°. These would include the naphthalene, as this substance boils at 425°. At a still higher temperature the anthracene oils come over, and the pitch remains behind. The anthracene oils and the pitch, it will be observed, represent some 75 per cent. of the whole. The tar from cannel coal appears to differ mainly from that above noticed in yielding a larger proportion of constituents boiling under 400°, with a correspondingly lower proportion of those boiling under 540°.

It might be supposed at first that the act of condensation would resemble an opposite process to that of fractional distillation—that the pitch would be removed or fall out of the gas first, then the anthracene oils, next the creosote oils, and so on. While this is the case to some extent, there are remarkable exceptions, as shown by the fact that substances boiling at nearly freezing-point are found in the tar; while others having boiling-points as high as 400° or more (naphthalene, for instance), are found in the gas. The substances comprised under the head of pitch and anthracene oils have a powerful solvent property upon the lighter constituents. If allowed to come in contact with ordinary gas, they reduce its illuminating value; and even ordinary tar will do so. At the 1880 meeting of the British Association of Gas Managers,† Mr. Greville Williams, F.C.S., gave some particulars of a small experimental scrubber in which ordinary gas was treated with tar, and thereby reduced in quality to the extent of two candles. The creosote oils appear to be practically neutral as regards the illuminating value; and the lighter constituents are absorbed by the gas, and tend to improve its quality. This, however, is only the case at atmospheric temperature. With a moderate increase—say to 100° or 120°—the power of the heavier to absorb the lighter constituents is gradually lost; so that gas may be scrubbed with "hot tar" not only without depreciation, but with actual advantage. Hence the desirability of cooling the gas very gradually, which simply comes to separating the greater part of the condensable matters at a high temperature. Mr. Greville Williams's apparatus was evidently so designed as to admit of trying the effect of tar at various temperatures; and it is a matter for regret that he has not published the results of experiments in this direction.

It is necessary to remark that the expression of quantities of light oils in percentages has a misleading effect, as the reader is likely to overlook the fact that the standard taken is the quantity of tar, which is only about 1-15th or 1-20th of the weight of the coal treated. Perhaps this is why there is a noticeable tendency to exaggerate the quantity of illuminants—that is to say, bodies which under other circumstances might be retained in the gas, with advantage, but which are absorbed out and removed by the tar. Now, 4 per cent. of light oil, boiling under 400°, really means only 0·2 or 0·3 per cent. of the quantity of coal carbonized. In Mr. Watson Smith's paper already referred to, the quantity of light oil distilling below 360° is stated as ranging from 1·4 to 8·4 gallons per ton of tar. But the weight of tar obtained per ton of coal ranges from about 1 to 1½ cwt., and these quantities therefore represent the yield from 14 to 20 tons of coal. So the production of light oils is a matter of from 1 to 4 pints per ton of ordinary coal; though, of course, it is considerably larger in the case of cannel. Assuming that all this could be carried in the form of vapour by the gas, it would only add from 12 to 50 lbs. to the value obtained from the coal in pounds of sperm. So that, with the ordinary system of condensation, carefully conducted, the loss of illuminating value in the form of light oils removed by the tar is not so important as some would have us believe.

The chief part of the light oils yielded by ordinary coal tar is composed of benzene and its homologues; and the remainder consists mainly of bodies belonging to the ethylene series. The latter predominate in cannel coal tar, and are chiefly concerned in making up the larger proportion of light oils. Members of the paraffin series are rarely found in coal tars to any appreciable extent; but they form the chief part of petroleum tars. The acetylene series are sparingly represented in coal tars; but they exist to a greater degree in oil tars. It is important to notice that the power of the heavier portions of the tar to retain the lighter hydrocarbons in solution obtains at temperatures considerably above the boiling points of the latter; for instance, appreciable quantities of ethylene, the boiling point of which is 134° below zero, have been found in tar. Therefore it must not be supposed that the depreciating action of the latter is confined only to bodies boiling at considerably above atmospheric temperature.

It has also been observed that, when gas is treated with light oil, the result is not a simple absorption of the vapour by the gas, but an exchange. The gas not only takes away vapour with it, but leaves some behind it. The selective action exercised in this case has not been systematically examined; but the "action of mass" is probably concerned in it. Many examples might be cited to show that chemical reactions are affected by the proportionate quantity of the re-agents present. Thus the result of mixing 90 per cent. of A with 10 per cent. of B may be widely different from that ensuing when the proportions are reversed, and B is the one that is largely in excess. An illustration of this is on record. A gas engineer supplied a scrubber with naphtha (*i.e.*, light oil), and passed gas through it in the hope of improving the illuminating power; but, to his surprise, he found that the gas was actually depreciated, and not improved. We have here a possible explanation of the efficiency of slow and gradual condensation as regards the prevention of naphthalene deposits. It is possible that the naphthalene that formerly passed on with the gas is now exchanged, during the latter part of the condensation, for vapours of a different character, which are not so liable to deposit with a slight reduction of temperature, or which, if they are thrown down, appear in the liquid, and not in the crystalline form.

Having noticed these particulars, we are in a position to inquire whether the hydraulic dip is responsible for any injury to the illuminating value of the gas made. The sudden shock of contact with the liquid secures a very large separation of condensable matters, resulting in the formation of the thick, heavy tar known as "hydraulic-main tar." The question is whether the suddenness of this operation may not result in the precipitation of useful illuminants. Judging from the analogy afforded by the experience at later stages of the condensation, this must obtain to some extent. Apart from this, the temperature in the hydraulic main is usually too high to admit of the exercise of solvent action as above noticed. It is usual to insist on the importance of having the dip sealed in water, and not in tar. This is not merely on account of chemical considerations, but because the tar is thicker and heavier than the water, and therefore increases the pressure due to the seal. Some proof of the prejudicial effect caused by the hydraulic seal is afforded by the fact that the result of experience has shown the advisability, not only of seeing that the gas passes through water and not tar, but also of reducing the seal to the lowest possible limit consistent with safety.

This is not at variance with the fact that subsequent washing or passing through liquids, as practised in the St. John and Rockwell apparatus, and other methods of treating the gas, while hot, to intimate contact with the products of condensation

* See JOURNAL, Vol, LIV. p. 1109; also Proceedings of the Society of Chemical Industry for 1889, p. 952.

† See JOURNAL, Vol. XXXV., p. 945.

may result in some advantage. The first passage through the dip differs from any that may subsequently follow, because it is attended with such an active separation of condensable matter. The supposition is that the gas is induced, by continued agitation with the lighter parts of the tar, to take up a larger proportion of them than would otherwise be the case. While some claim has been put forward as to increased illuminating power resulting from the use of hot scrubbers or washers, there is no proof of the actual permanent retention of a larger proportion of illuminants than would result from careful treatment of the gas in the ordinary way. It is difficult to see how matters once separated from the gas, in the course of properly conducted condensation, can be returned to it with advantage, and retained by it right through to the consumer's burner; although, as is illustrated by the albo-carbon light, gas may be caused to absorb a large quantity of such matters by being heated. But when it has been so treated, it must be at once consumed before the temperature falls. It is probable that gas passed through the reservoir of an albo-carbon lamp, and subsequently cooled to its original temperature, would lose the bulk of the illuminating value it had gained.

The best way of guarding against the solvent action exerted by the heavier constituents of the tar upon the illuminants present in the gas, is to remove the liquids at the hottest possible point. The ordinary practice is to take them off at short intervals throughout the whole system; and for this purpose a large number of overflows, and a somewhat elaborate system of tar-pipes, are necessary. A simple rising pipe, of sufficient diameter and length to act as a chamber condenser, would be capable of effecting the whole of the requirements. The lighter portions of the tar, which are deposited at the outlet or higher end of the pipe, would flow back and mix with the heavier portions; so diluting them in respect to solvent activity. The overflow-box may be situated as nearly as possible at the outlet of the hydraulic main; or, if the arrangements admit, the condensed matters may be allowed to flow through the main itself. This plan admits of a considerable simplification in the matter of tar-collecting apparatus, as there need not be more than one or two overflow boxes from which a direct pipe, having but few bends or curves, can be laid to the tar-well.

Lighting London Streets.—In the course of a communication recently addressed to the *Architect*, Mr. M. E. Walcott gave some interesting historical particulars in regard to the public lighting of London. He stated that in 1661 the streets were directed to be lighted with candles or lanterns by every householder or occupier fronting the main road from nightfall to 9 p.m., the hour of retiring to bed. In the last year of the reign of King Charles II., one Edward Heming obtained the right of lighting the streets with lanterns placed over every tenth door, from 6 p.m. on moonless evenings until midnight, between Michaelmas and Lady-day. During the reign of Queen Anne, in July, 1708, Mr. Michael Coke introduced globular glass-lamps with oil-burners, instead of the former glimmering lanterns. In 1716 an Act was passed which enjoined every householder to furnish a light before his door from 6 till 11 o'clock at night, except on evenings between the seventh night of each new moon and the third after it reached the full. In a few years a company was formed to light the streets from 6 p.m. until midnight; each householder who paid poor rates being required to contribute for this purpose 6s. a year. Gas on its introduction, in the beginning of the present century, presented such a novel spectacle to the eyes of the Foreign Ambassadors, that it is said they were vain enough to imagine that the brilliant lamps were only a part of a general illumination to celebrate their arrival.

The Contamination of Water by Lead.—When noticing, in the JOURNAL for Sept. 9 last, the proceedings at the last congress of the Sanitary Institute, we briefly referred to a paper communicated by Dr. Percy F. Frankland, but, for want of time, taken as read, on "Lead-Poisoning by Soft Water Supplies." It may be remembered that the author expressed the opinion that of all the methods of preventive treatment in existence, the most efficacious was the addition of a certain proportion of carbonate of soda to the water. He says the method possesses the advantage of avoiding the expensive erection of filter-beds, with the necessary frequent renewal of the filtering material; further, the "dose" of carbonate of soda can be regulated according to the necessities of the case, and even with the same water it may advantageously be changed from time to time, inasmuch as the activity, in the case of surface water, generally varies greatly with the season. It is more effective than caustic lime, and much easier to handle; it is also more efficacious than phosphate of soda. The quantity of carbonate of soda must be ascertained by actual experiment in every instance; but in an extreme case Dr. Frankland found it necessary to use 5 parts of soda to 100,000 parts of water by weight, which, with carbonate of soda at £5 a ton, represents a cost of 3d. per 1000 gallons. In most cases, probably, a very much smaller amount only is necessary; and if the quality of a water supply be watched from time to time, the quantity could be frequently varied, and at certain seasons even suspended. Although carbonate of soda is the safest and most expeditious method of counteracting the lead-dissolving power of soft water, Dr. Frankland does not wish to discountenance the treatment of such waters by filtration.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The Eighty-fourth Quarterly Meeting of this Institution was held last Saturday, at the Memorial Hall, Albert Square, Manchester. The PRESIDENT (Mr. W. W. Hutchinson, of Barnsley) occupied the chair; and there was a fair attendance of members.

MINUTES OF LAST MEETING.

The HONORARY SECRETARY (Mr. S. S. Mellor, of Northwich) read the minutes of the last meeting, held at Lancaster on Aug. 30; and these were confirmed.

ELECTION OF PRESIDENT.

The next business on the *agenda* was that of electing the President to take office at the next meeting, in February, 1891.

The PRESIDENT said it had been usual for the occupier of the chair for the time being to propose his successor in that office. He had to place before the meeting a motion he felt certain would meet with the approbation of all the members of the Institution. It was that Mr. T. O. Paterson, of Birkenhead, be elected President for the ensuing year. He need not dwell on the many qualifications which Mr. Paterson possessed for the position. The Committee were unanimously of opinion that he was eminently fitted for it; and he (the President) had no doubt that the members would ratify their choice.

Mr. T. BANBURY BALL (Rochdale) said he was glad to have the opportunity of seconding the nomination of his friend Mr. Paterson. He had no doubt that the services he would be able to render to all of them would be such as to entitle him to their very best thanks at the close of his term of office. He had had the pleasure of Mr. Paterson's acquaintance for some years, and knew that he possessed all the qualifications which they looked for in the gentleman at the head of so important an Institution as theirs.

Mr. W. R. CHESTER (Nottingham) remarked that he had much pleasure in supporting the nomination of Mr. Paterson. He came of a family long and honourably connected with the gas industry, and was the son of a distinguished father, and the brother of a no less distinguished gas engineer. They were conferring quite as much honour upon the Institution, in electing him President, as they were bestowing upon him in placing him in that position.

The resolution was carried with applause.

Mr. PATERSON said he sincerely thanked the members for the resolution they had passed, and the gentlemen who had spoken for the manner in which they had brought his name forward. The office was certainly not a light one to assume, having regard to the eminence of those who had so ably occupied it in years gone by. He felt the responsibility very keenly; but, as they had done him the honour of electing him, he would do his best to fill the position. His efforts would be directed to advancing the prosperity of the Institution, and to bringing before the members any matters of interest which might arise from time to time. He hoped that, at the end of the year, they would be of opinion that at least he did not deserve their censure.

PAPERS AND DISCUSSIONS.

The remainder of the business consisted in a brief discussion of Mr. G. E. Saville's paper, read at the previous meeting, on "A Combined Washer, Tar Extractor, and Exhaust Regulator," and in the reading of papers by Mr. W. R. Chester, on "The Supply of Steam to Regenerative Furnaces;" by Mr. T. Newbigging, C.E., of Manchester, on "Lime Burning;" and by Mr. W. Gadd, on the question of the force required to resist wind pressure in a gasholder guided from the base—the latter being accompanied by a demonstration. All the papers, except that of Mr. Newbigging, were followed by discussions, which will be reported in future issues of the JOURNAL.

At the close of the formal business, the members had tea together at the Star Hotel.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Quarterly Meeting of this Association was held at the Great Western Hotel, Birmingham, on Thursday, Nov. 13—Mr. H. PEATY, of Burslem (the President) in the chair. There was a fair attendance of members.

The HON. SECRETARY (Mr. J. S. Reeves, of Bilston) having presented the minutes of the previous meeting, they were adopted.

NEW MEMBER.

On the motion of the PRESIDENT, Mr. A. J. Edwards, Manager of the Taunton Gas-Works, was elected a member of the Association.

ELECTION OF PRESIDENT.

Mr. P. SIMPSON (Rugby) proposed that Mr. C. Stafford Ellery, of Bath, be the next President. He said the members all knew Mr. Ellery's abilities; and they would be pleased by his acceptance of the office.

Mr. R. O. PATERSON (Cheltenham) expressed his pleasure in seconding the nomination; saying he was sure the members

would find in Mr. Ellery an excellent President, and one whom they all desired to honour.

The PRESIDENT said the proposition was beyond doubt a very popular one. They all recognized the fact that Mr. Ellery had rendered good service to the Association, not only in reading papers, but also in taking part in the discussions.

The motion was carried by acclamation.

The PRESIDENT-ELECT thanked Mr. Simpson and Mr. Paterson for the kind remarks they had made in regard to him; and the members generally for the honour they had conferred upon him by electing him to the honourable post of President. He said it was not an easy position to fill; but, with their kind forbearance, he would do his best to maintain the dignity of the office.

ELECTION OF OFFICE-BEARERS.

Mr. CHARLES HUNT (Birmingham) proposed the re-election of Mr. P. Simpson, of Rugby, as Treasurer of the Association; and the proposition was agreed to.

Mr. SIMPSON having returned thanks,

Mr. G. WINSTANLEY (Coventry) next proposed the re-election of the Honorary Secretary. He said the members all knew what an admirable Secretary Mr. Reeves had made during the past two years; and they all hoped he would consent to remain in office for years to come.

Mr. J. F. BELL (Stafford) seconded the motion, and it was carried.

Mr. REEVES thanked the meeting for the honour they had again conferred upon him; and said he should be pleased to carry on the work for another year. He did so, however, on the understanding that at the end of the year he should be relieved of both the honour and the work connected with the position of Secretary.

Mr. H. TAPLAY (Stoke-on-Trent) moved the election of Mr. W. T. Tew, of Warwick, and Mr. J. T. Lewis, of Wellingborough, as members of the Committee in the place of Mr. W. R. Cooper and himself, who retired.

Mr. H. HACK (Birmingham) seconded the motion, and it was unanimously agreed to.

Mr. W. W. Hulse (Longton) and Mr. C. Meiklejohn (Oldbury) were next elected Auditors.

VOTES OF THANKS.

Mr. B. W. SMITH (Smethwick) proposed a vote of thanks to the retiring President. He said the members all recognized the valuable services the President had rendered during his year of office, and how he had worked for the general good of the Association. He had also contributed very much to the social gatherings which had taken place; and, in giving him a cordial vote of thanks, it would be some solace to him for any anxious hours he had spent during his presidency.

Mr. TAPLAY seconded the motion with much pleasure; remarking that Mr. Peaty was always willing to do his best for those about him, and especially for the Association.

The motion was carried amid applause.

The PRESIDENT, in acknowledging the vote, said he regretted that he had not been able, during his year of office, to do as much for the Association as he should have wished; circumstances having occurred which had caused some of his plans to remain incomplete. If, however, the members had been pleased with what he had done, he was gratified; and he thanked them very warmly for the vote they had so cheerfully accorded to him.

Mr. ELLERY then proposed a hearty vote of thanks to the other officers. In doing so, he remarked that there was more work before the Association in the future than there had been in the past; and possibly there were more severe struggles to be engaged in than had yet been experienced. With such a future before the Association, they needed, to keep them right, such services as the Committee and Mr. Reeves were so well able to render.

Mr. HACK seconded the motion, and it was carried.

Mr. SIMPSON briefly acknowledged the vote.

CHANCE'S SULPHUR-RECOVERY PROCESS.

The members then proceeded to the consideration of the paper read at the February meeting by Mr. C. Meiklejohn (Oldbury) on "The Recovery of Sulphur from Alkali Waste" (see JOURNAL for March 18, p. 493), and the discussion of which was adjourned.

The PRESIDENT: We have now to discuss the paper read to us on a former occasion by Mr. Charles Meiklejohn, on Chance's sulphur-recovery process. I am personally extremely obliged to Mr. Meiklejohn for giving us the paper, which will bear reading several times. I have done so, and have been benefited by a further perusal. The author gives us a complete and clear statement of Mr. Chance's discovery for the recovery of sulphur from waste products. It is a question of great interest to us, and we are all indebted to Mr. Meiklejohn for the lucid and able way he explained the process.

Mr. J. F. BELL (Stafford): It is rather late in the day to enter on a discussion of a paper which was read to us six months ago; and I certainly think it is far better for the discussions to take place immediately after the reading of papers. This paper was a most interesting one, and contains many very valuable points; but when so much time has been allowed to elapse, we forget some of the points made. It has been said that "rubbish is matter out of place;" and I think that Messrs. Chance have proved that to be the case with reference to alkali waste formed under the Leblanc process. Messrs. Chance Bros. spent some £10,000; and yet were not rewarded with success. Still they persevered for another five years; spent more money, and at last we know the result—complete success crowned their labours and studies. I think one point is brought out in the paper—the fact that one discovery of a process leads up to the development of other processes. It was Mr. Claus who, in 1882, found out that sulphuretted hydrogen could be decomposed by being passed through oxide of iron; and by the mixture of air with the gas, the sulphur could be liberated. This was noticed by Mr. Chance, and is now an important part of their process. I think we ought to congratulate Mr. Meiklejohn upon having gone out of the bounds of the Association work, and giving us such a paper as he has; for such papers act as a tonic to us. The paper possesses special interest to me, as for four years I have been using Claus's sulphur-recovery process in connection with the distillation of ammoniacal liquor for sulphate of ammonia, which can be carried out without the slightest nuisance. Another point struck me. The value of spent oxide is decreasing gradually. I well remember not many years ago we could obtain 7d. per unit; now it is 3d. and 3½d. per unit. Hence we ought to turn our attention to such questions as the recovery of sulphur in a more marketable form. We can obtain £3 10s. to £4 per ton for sulphur, which is three times more than we obtain for sulphur in the form of spent oxide. You will agree with me that, as the future depends in a large measure upon small things, we ought to give attention to such questions.

Mr. H. HACK (Birmingham): Some remarks fell from Mr. Bell suggesting loss of interest in the paper because the discussion upon it has been postponed. For my own part I think it is a great advantage to the members when a paper is read for the discussion to be adjourned, as it is very difficult for us who have not seen the paper before to master its details and speak upon it straight off. This morning we have had put into our hands a somewhat lengthy paper by Mr. Lewis; and I say it is almost impossible for anyone to digest the figures therein given upon so short notice, and I understood it was the intention of the Committee some time back to let us have proofs of papers a few days before they are presented. If this could be done, we should be able to carefully consider beforehand any tables or formulæ contained therein, and be in a better position to discuss the paper at the meeting. It will be remembered that the discussion of this paper was postponed, to enable us to peruse it at our leisure, and to study the equations and formulæ it contains; and for my own part, I may say I have derived much pleasure in doing so, and have found no flaw in the formulæ presented to us. We must all be extremely indebted to Mr. Meiklejohn for the able paper, and for the graphic description he gave of Messrs. Chance's process. Since the last meeting, I have had the privilege of looking over Messrs. Chance's works, and of witnessing the process in actual operation; and I have to thank that firm for granting me the favour. I followed the whole process through, and can assure you it was an intellectual treat. So much was there to be seen of interest, that I regretted my visit was not measured by days instead of hours. It was my good fortune to be present at the time when the sulphur chambers were opened; and then I felt that the glowing description which Mr. Meiklejohn gave of the appearance of these chambers was in no way exaggerated. It was veritably a "scene of indescribable beauty." The way in which the sulphur was hanging to the walls of the chambers in the shape of pears, as though placed there by hand (as mentioned by the author), was really marvellous. I also went into the building where the carbonators were in operation; and I was much pleased with the very easy and smooth way in which all the numerous valves and the apparatus generally were worked. This tended to give me confidence in regard to the facility of working the Claus ammonia process, for which so many taps, valves, and pumps are required, and about which I had before some doubt. I think the paper is extremely valuable to us, not only on account of the history it gives us of this discovery, but because it should set us thinking as an Association whether we cannot do something further in the way of preventing waste in our own industry than has as yet been done, and to which the author referred early in the paper. There is the question of the possibility of profitably eliminating and utilizing the large percentage of nitrogen and sulphur of the coal, which now remains in the coke; I am sure users of coke of all kinds, especially iron manufacturers, would welcome any discovery that would assist in this direction. Then there is the residue from the spent oxide kilns which still remains practically a waste product. There is also before us the comparatively new system of purification by lime and oxygen, or lime and air, whereby the sulphur is thrown down in the lime; and a point which will deserve careful consideration is the question of whether economical means cannot be devised whereby this sulphur can be recovered in a marketable form from the lime. There is one item in the paper to which I wish to refer—viz., the large percentage of the sulphur recovered. It is said to amount to 95 per cent. I should like to ask if that 95 per cent. is an average, or only an occasional result. If the former, it shows how exceedingly well the plant is constructed and the process carried on. If this be so, I do not see why, with equal care, there should be much loss of ammonia in

connection with Claus's process; why we should not ultimately succeed in recovering practically the whole of the ammonia used in that process. Another remark in the paper struck me as important—viz., the effect of the nitrogen on the action of the carbonators. It is said that the nitrogen was at first found a "stumbling-block" in the operations; but when allowed to escape, a "richer compound of sulphur and lime was formed." Now the absence of nitrogen is a point which has also been claimed for the superiority of the oxygen process in connection with lime purifying over the value of atmospheric air for the same purpose—that, although it may be at present more costly, yet better results, space for space, are obtained by the use of pure oxygen. I cannot thank Mr. Meiklejohn too much for his very valuable paper, which I certainly think is one of the best ever presented to this Association.

Mr. C. HUNT (Birmingham): I think I can confirm what fell from Mr. Hack as to the value of deferring discussions. Mr. Bell's speech appeared to me to be a refutation of his argument; for although we all recognize Mr. Bell's aptitude in discussing technical matters, I venture to think that even he has gained some advantage from a further study of the paper which the interval has afforded him. I should like to join in thanking Mr. Meiklejohn for his very lucid explanation of the process, which I had previously seen in operation, by the courtesy of Mr. A. M. Chance. It is undoubtedly a great achievement; but our admiration of it must not blind us to its effect on our own industry. Reference has been made to the depreciation in the value of spent oxide; but it has not been stated how far that depreciation has been due to the process which has been so successfully carried out at Messrs. Chance's works. As a matter of fact, I believe spent oxide has depreciated in value fully one-half, owing to the success of this process. Since its application, pyrites importers have reduced their prices—whether permanently or otherwise remains to be seen; whilst its value in connection with gas manufacture is at least problematical. I am sorry to think that it may be of very little use to us. Spent lime utilized in this process consists largely of sulphide of calcium; and it must be in that form to be of any use at all. There are very few works of any magnitude at the present day in which the lime used is thrown away as sulphide of calcium. The use of air or oxygen fixes the sulphur in a solid form; and I think I am right in saying that is of no use in connection with this process. Our chief hope lay in the possible recovery of the sulphur which is fixed in the solid form in the lime—that is, assuming the lime process in connection with air or oxygen be generally adopted. Failing this, we shall have to say this recovery process, admirable as it is, and beneficial as it must be to the country at large, is prejudicial rather than otherwise, to the gas industry. I hope we shall have many such papers from Mr. Meiklejohn in the future.

Mr. C. MEIKLEJOHN (Oldbury): I can only say that my first reason for attempting to give this paper at all resulted from a desire I felt as a member to contribute in some way to the proceedings. I could think then of no other subject which I could treat in a novel form; and therefore I had recourse to a description of this process, which I feel is not uninteresting from a chemical point of view. With regard to whether the process is practically applicable for the recovery of sulphur from the refuse lime of gas-works, where air or oxygen is used for revivification, I am inclined to agree with Mr. Hunt, because the sulphur is thrown down in the solid form; whereas it must exist as sulphide of lime, in order that the carbonic acid may liberate it as sulphuretted hydrogen. In the sulphide of lime, used to purify the gas from sulphur compounds, other than sulphuretted hydrogen, and in all refuse lime containing about 30 per cent. of sulphide (CaS), the sulphur exists in a form which would make it pay handsomely to recover by this process. Mr. Hack asked a question as to the percentage of sulphur recovered. The total sulphur contained in the vat waste is recovered to the extent of 90 per cent.; the remaining 10 per cent. being accounted for in the screenings of the waste, which are not treated, and in the oxide of iron purifier, which is used to catch the traces of sulphuretted hydrogen, escaping with the inert nitrogen coming off from the carbonators. In the form of sulphuretted hydrogen, as much as 98 to 99 per cent. is recovered as sulphuric acid.

On the motion of the PRESIDENT, seconded by Mr. HACK, a vote of thanks was accorded to Mr. Meiklejohn for his paper.

WEEKLY AND MONTHLY PAYMENTS FOR GAS.

Mr. J. T. LEWIS (Wellingborough) then read the paper on the above subject, which has already been given in the JOURNAL (*ante*, p. 1046); its discussion being deferred till the next meeting.

The members then proceeded to the Swan Village works of the Birmingham Corporation, to see Elliott's system of retort-charging; returning afterwards to the Windsor Street Works, to see Coze's system of charging and drawing inclined retorts, as modified by Mr. Hunt. This part of the day's proceedings was noticed in the JOURNAL for the 18th ult. (p. 1045). A vote of thanks was accorded to the Engineers (Messrs. Hack and Hunt) for their courtesy in explaining the specialities at their respective works, and to the Gas Committee of the Corporation for permitting the visit. The members afterwards dined together at the Great Western Hotel.

GASEOUS ILLUMINANTS.

At the Society of Arts on Monday evening last week, Professor VIVIAN B. LEWES, F.I.C., F.C.S., of the Royal Naval College, Greenwich, gave the first of the series of Cantor Lectures which he is to deliver before Christmas, the syllabus of which was published in the JOURNAL for the 18th ult.

The lecturer began by remarking that, although born scarcely a century ago, gaseous illuminants had made such strides within the last ten years, that no excuse was needed for taking them as his subject; and in doing so, he proposed to treat more especially the new processes which are making their mark in the gas world, and omit those which are either obsolete or gradually being superseded. He then went on to say that just 200 years after Van Helmont (in the seventeenth century) first used the term "gas" to describe aëriform bodies, Faraday defined a gas as being the vapour of a volatile liquid, existing at a temperature considerably above the boiling-point of the liquid, and that the condensing-point of the gas was merely the boiling-point of the liquid producing it. This definition was contested at the time, as several of the gases had not then been condensed; but now it was known that the condensation of any gas to the liquid form was merely a question of sufficiently intense cold, and pressure. For instance, at ordinary temperatures, carbon dioxide, or carbonic acid gas, was as good an example of an aëriform body as one could adduce, and was recognizable from air only by its physical and chemical properties; but subject it to a temperature of − 78·2° C., and it would condense to a clear limpid liquid which might easily be mistaken for water, and which, if the temperature were again allowed to rise to 0° C., would require a pressure of 36 atmospheres to prevent it again assuming gaseous form. If it were released from this pressure, it would at once become gaseous again, and in doing so would absorb so much heat, that a temperature close upon 100° C. was produced, and some of the liquid was frozen into the solid form. This showed that the state of aggregation of the body was dependent on the existing temperature.

Professor Lewes then proceeded to explain that gases containing hydrogen, compounds of hydrogen with carbon, and compounds of these two with other elements, have most of them so strong an affinity for the oxygen contained in the atmosphere, that the heat emitted by a burning match is generally sufficient to determine combination between the gases; and where the heat evolved by the combination is sufficient to raise the gases or vapour to incandescence, the phenomenon of flame is the result. Some flames have the power, under certain conditions, of emitting light, while others have no photometric value; and it is a matter of the gravest importance to the gas world that as clear a conception as possible should be obtained of the conditions and cause of luminosity in flames. A visible flame may either be solid—that is to say, composed of a solid mass of incandescent particles—or it may have a distinctive internal structure, and show zones in which varying phases of combustion are taking place; and it is to this latter class that all flames produced by a gas issuing from a burner belong. A moment's consideration will make it manifest that if one gas is issuing in a steady continuous stream into an atmosphere containing the gas with which it is to combine, if combination is set up (in other words, if the gas is lighted), the action can only go on for a limited space from the surface where the two gases meet, and hence such a flame must, of necessity, be hollow, and will contain a central zone in which entire absence of air causes absence of combustion—an intermediate zone in which partial combustion is taking place, only a limited supply of air being able to penetrate. This zone was practically in all cases the light-producing zone; while outside this again it is just possible to discern an envelope of non-luminous flame, where the excess of air destroys all luminosity for reasons which will be discussed later on. The flame is not in contact with the rim of the burner from which the gas is issuing; this space being claimed by some observers as constituting a fourth part.

In the *Philosophical Transactions* for 1817, Sir Humphry Davy first propounded his theory that the cause of luminosity in ordinary flames was the incandescence of nascent carbon—a theory which was accepted as the true one until the researches of Dr. Frankland in 1868, on the effect of pressure on non-luminous flames, showed that, under certain circumstances never likely to arise in a gas-flame, luminosity might be due to other causes. Later observers have shown that luminosity in a flame is to a great extent affected by temperature. These factors, though of the greatest importance, do not affect the truth of the original theory. In the last contribution to the subject, Davy's theory had, said the lecturer, been attacked by Mr. F. J. Rowan in a paper "On Flame" read before the Glasgow and Scottish Section of the Society of Chemical Industry early in 1889; and inasmuch as his paper had been printed in full in the JOURNAL OF GAS LIGHTING,* and hence had found its way into the hands of everyone interested in gas lighting in the kingdom, he thought it would be of interest to fully discuss a question of such vital importance to the gas industry before passing on to other branches of the subject. This he proceeded to do as follows:—

In the introduction to his truly remarkable paper, Sir

* See Vol LIII. pp. 761, 854.

Humphry Davy says, while alluding to a paper published in one of the early numbers of the *Journal of Science and Arts*: "I have given an account of some new results on flame which show that the intensity of the light of flames depends principally upon the production and ignition of solid matter in combustion." It is round this statement that the battle of luminosity has raged; the word "principally," however, being lost sight of, and the theory being more often propounded in the words used by Mr. Rowan, that "the presence of solid particles suspended in the flame (or in immediate contact with the burning gas) is essential to its luminosity"—an idea which Davy never had, as is shown by him later in the paper defining flame as follows: "Flame is gaseous matter heated so highly as to be luminous;" and again: "When in flames, pure gaseous matter is burnt, the light is extremely feeble." Moreover, he alludes to "common flames"—evidently meaning the flames of candle, lamps, or gas; in all which cases I think it can be proved beyond a doubt that his theory, as expounded by himself, was perfectly correct. On June 11, 1868, Professor E. Frankland read a communication before the Royal Society, in which he described experiments which led him to doubt Sir Humphry Davy's theory. He points out that the deposit of soot formed when a cold surface is held in a gas or candle flame is not pure carbon, but contains hydrogen, which can only be got rid of by prolonged heating in an atmosphere of chlorine. Also that many flames possessing a high degree of luminosity cannot possibly contain solid particles. Arsenic burnt in oxygen gives a bright white light; yet as arsenic volatilizes at 180° C., and the arsenic trioxide forms at 218° C., it is evident that at the temperature of incandescence (which is at least 500° C.) there can be no solids, but simply vapours present in the flame; and for the same reason, the intense light resulting from the burning of phosphorus in oxygen cannot be explained by the solid particle theory. From these results, Dr. Frankland considers that "incandescent particles of carbon are not the source of light in gas and candle flames, but that the luminosity of these flames is due to radiations from dense but transparent hydrocarbon vapours;" and he further shows that non-luminous flames, such as that produced by carbon monoxide and hydrogen, can, when burning in an atmosphere of oxygen, be rendered luminous if the ordinary atmospheric pressure is increased to 10 atmospheres, so as to prevent or retard as far as possible expansion during combustion. From Dr. Frankland's experiments, there is no doubt that the luminosity of a flame is increased by pressing around it the atmosphere in which it is burning, and also that rarefaction has the opposite effect—a point also worked at by Davy; but his experiments do not show that incandescent particles of carbon are not the principal source of luminosity in a gas-flame. He also shows that the higher the density of the vapours present in a flame, the more likely is it to be luminous.

In 1874, Soret attempted to demonstrate the existence of solid particles in a luminous hydrocarbon flame, by focussing the sun's rays on the flame, and examining the reflected light by means of a Nicol prism; but neither his research nor that of Burch, who repeated his experiments, using the spectroscope instead of the prism, showed more than that solid particles are present. Herr W. Stein, in considering Dr. Frankland's objections to Davy's theory, pointed out that the soot which is deposited from a candle or gas flame, and which Frankland looked upon as a condensed hydrocarbon, contains 99·1 per cent. of carbon and only 0·9 per cent. of hydrogen, which is about the quantity of hydrogen one would expect to be occluded by carbon formed under these conditions, and he also pointed out that if the soot were a heavy hydrocarbon condensed by a cold surface, cooling the vapour present in the flame, it ought to again become volatile at a high temperature, which it does not. The next steps in the controversy were the attempts made by Hilgard, Landolt, and Blochman, to trace the actions taking place in various flames by withdrawing the gases from different parts of the flame and determining their composition. Ordinary 16 to 17 candle coal gas as supplied in London may roughly be taken as consisting of:—

	Per Cent.
Hydrogen	51·6
Marsh gas, or methane	36·7
Illuminants	5·8
Carbon monoxide	5·1
Carbon dioxide	0·0
Nitrogen	0.6
Oxygen	0·2
	100·0

Of these the three last only exist as traces, and do not play any part in the combustion. Of the remainder, it is found that the hydrogen burns most rapidly; then the carbon monoxide; next the marsh gas; while the illuminants are the slowest to burn. When, however, at the bottom of the flame, hydrogen and carbon monoxide enter into a non-luminous combustion, forming water vapour and carbon dioxide with the oxygen of the air, they have by no means completed their function, as the aqueous vapour, passing upwards through a zone of intense heat, becomes again dissociated to a certain extent into hydrogen and oxygen; while the carbon dioxide, coming into contact with incandescent carbon, liberated from the heavy hydrocarbons forming the illuminants, is once more reduced to carbon monoxide—these only finally completely re-combining to saturated products of combustion in the outer non-luminous zone of the flame. Landolt took an ordinary rich coal-gas flame 3½ inches in height, and traced the changes taking place by withdrawing the gases in the flame at various points from the orifice of the burner up to 2 inches above it, with the following results:—

Height from Burner in Inches.	0.	0·39.	0·79.	1·18.	1·58.	1·97.
Composition of Gas in Flame.						
Hydrogen	22·66	14·95	15·49	15·54	14·50	11·95
Marsh gas	33·77	30·20	28·34	21·55	11·92	3·64
Carbon monoxide	7·34	14·07	14·05	14·58	22·24	25·14
Olefines	7·29	7·49	7·87	7·94	7·05	5·45
Oxygen	0·66	0·78	0·47	..	..	..
Nitrogen	29·41	38·66	140·78	184·23	270·45	307·10
Carbon dioxide	1·94	2·34	10·11	14·98	23·76	32·34
Water	8·34	11·60	38·85	52·55	72·67	75·61

He used a gas containing a high percentage of illuminants, and on examining his results we see that the hydrogen is the first to burn, as one would expect from its relatively low igniting point and great rapidity of combustion. The burning of the carbon monoxide cannot be traced inthe same way, as it is formed more rapidly (by the incomplete combustion of the marsh gas) than it burns, so that a steady increase in the proportion present takes place while the marsh gas steadily burns away, until a height of 1½ inches is attained, when its combustion becomes very rapid. Practically, the illuminants do not undergo any change at first—indeed, they slightly increase in quantity from the decomposition by heat of some of the marsh gas into acetylene. They only begin to decompose at a height of 1½ inches above the orifice of the burner; and then burn rapidly in the highest part of the flame. Moreover, a most important fact to be noted is that at the height of 1½ inches there is a sudden rise in the quantity of carbon monoxide at the moment that the illuminating olefines begin to disappear—a result undoubtedly due to the action of the nascent ignited carbon or carbon dioxide. Among the illuminants are several hydrocarbons, the probable composition of which will be discussed in the next lecture. These are gradually broken down into intermediate stages in the lower part of the flame, until finally they become marsh gas and carbon; and it is the carbon in excessively minute particles which at the moment of liberation is heated to incandescence, and "principally" gives the light of the flame—the marsh gas originally present, and also that formed from the heavier hydrocarbons, adding its quota to the luminosity by still further decomposition during combustion, and finally becoming carbon dioxide and water. In 1876, Dr. Karl Heumann made a most important contribution to the theory of luminous flames in some papers published in Liebig's *Annalen*, in which he carefully went over the work of previous observers, and, by a large number of original experiments, proved that Davy's theory was correct, but that other causes also affected the degree of luminosity in a gas or candle flame.

In the ordinary atmospheric burner in which a mixture of coal gas and air burn with a non-luminous flame, it was supposed that the admixture of air, by supplying oxygen to the inner portion of the flame, caused immediate and complete oxidation of the hydrocarbons, without giving time for the liberation of carbon in the flame, and consequently luminosity. More modern researches, however, have proved this to be utterly wrong. The loss of luminosity is due to two causes—first, to the diluting action of the air introduced; secondly, to the fact that when a gas is so diluted it requires a far higher temperature to break up the hydrocarbons present than when the gas is undiluted, and therefore the temperature which serves to liberate carbon and render the undiluted gas-flame luminous, is totally insufficient to do so in the diluted gas. Consequently the hydrocarbon burns to carbon dioxide and water without any such liberation, and hence with a non-luminous flame. The truth of this theory can be easily proved by the fact that diluting the gas with nitrogen, carbon dioxide, or even steam, serves to render it non-luminous, and therefore more rapid oxidation has very little or nothing to do with it, while the non-luminous flame can again be rendered luminous either by heating the mixture of air and gas just before combustion, or by heating the air with which the gas is diluted. This being so, it is evident that in the non-luminous flame we have the same hydrocarbon present as in the luminous flame; and anything that will tend to break them up, and liberate the carbon before the hydrocarbons are consumed, should again make the flame luminous. That heat will do this has been already shown; but it can be demonstrated in a still more striking way. It is well known that chlorine gas and bromine vapour will both support the combustion of a gas containing much hydrogen, but that the combustion is very different from that of the same gas burning in air, as the chlorine or bromine, having no affinity for the carbon, combines with the hydrogen only, and deposits the carbon in clouds of soot; in other words, at the temperature of flame, chlorine will break up the hydrocarbons and liberate solid carbon. If now a small quantity of chlorine is led into the non-luminous Bunsen flame, it at once becomes luminous; proving conclusively that luminosity is due to solid particles of carbon liberated in the flame. Again, Heumann points out that a small rod held in the luminous flame becomes rapidly covered on its lower side with a

deposit of soot; that is to say, the soot is present in particles in the flame, and the uprush of the gas drives it against the rod and deposits it there. If the soot were present in the flame, as Frankland supposed, in the state of vapour, and the rod merely acted by cooling and condensing it, the soot should be deposited on all sides of the rod; while a still further proof is that if the soot existed as vapour in the flame, then if the rod were heated to a high temperature no soot should be deposited on it, whereas the soot deposits on a heated surface just as well as on a cool one.

It has been objected to the "solid particle" theory that, if it were true, solid carbon particles introduced into a non-luminous flame should render it luminous and make it look like an ordinary gas-flame, whereas it simply gives rise to a cloud of sparks. But it must be remembered that the "nascent" carbon, as it is liberated from the decomposing hydrocarbons, is in the molecular condition, and has a very different degree of coarse-grainedness to any preparation of charcoal or lampblack we can make; and that, although our finest particle is a mass which takes so long to burn that it leaves the flames only partly consumed, and is projected into the air as a spark, the molecular particles of carbon are consumed as soon as they are rendered incandescent, and a steady luminosity, free from sparks, results. It is possible, however, to make the particles in a luminous flame roll themselves together, when they can be either deposited in a very coarse kind of soot, or be seen as glowing sparks and particles in the mantle of the flame. This can be done when two luminous flames are allowed to rush against each other or against a heated surface. Heumann also shows that the luminous mantle of a flame is not altogether transparent, and that the thicker the flame-layer, and the greater the number of solid particles contained in it, the less transparent does it become. If a non-luminous flame—say, hydrogen—is charged with the vapour of chromyl dichloride (CrO_2Cl_2), chromic oxide is produced; and this flame, which undoubtedly contains solid particles, is quite as transparent as the hydrocarbon flame. Finally, those flames which undoubtedly owe their luminosity to the presence of finely divided solid matter produce characteristic shadows when viewed in sunlight; the only luminous flames which do not throw shadows being those which consist of glowing vapours and gases. Luminous gas-flames, oil-lamp flames, and candle, flames produce strongly-marked shadows in sunlight, and therefore contain finely-divided solid matter; and that this can be nothing but carbon is evident from the fact that all other substances capable of remaining solid at the temperature of the flames are absent.

From the foregoing considerations, it seemed to the lecturer that Sir Humphry Davy's statement that the intensity of the light of flames (such as those produced by candles, oil, or gas) depends principally upon the production and ignition of solid matter in combustion, was undoubtedly the true one; and it must also be borne in mind that the degree of luminosity of a flame is affected by the constituents of the gas other than the heavy hydrocarbons—some, like marsh gas, although ordinarily burning with an apparently non-luminous flame, and separating no soot, adding considerably to the luminosity at the temperature of the flame, while others, like carbon monoxide, reduce it. This question, which he hoped to discuss in the next lecture, has, he said, most important bearings upon the illuminating values of the newer forms of gaseous illuminants. Finally, in considering the amount of light obtainable from a flame, the question of temperature, which would be brought forward when he came to speak of the newer forms of gas-burners, must not be lost sight of. The luminosity of a flame is increased by an increase of density in the media in which it is burning, and is decreased by rarefaction—an effect supposed by Dr. Frankland to be owing to the alteration of density and alteration of the mobility of the oxygen molecules in the air. This view, however, had been contested by Wartha, who concluded that it was due to the effect of pressure on the dissociation point of the hydrocarbons burning in the flame; this taking place more rapidly under increased pressure, and therefore liberating the carbon more quickly. However this might be, the effect of pressure on luminous flames was very marked, even under ordinary atmospheric pressure; the difference of an inch in the barometric column making 5 per cent. difference in the luminosity. A burner giving 100 units of light with the barometer at 30 inches would only give 95 units if it fell to 29, while a rise to 31 inches would mean an increase of the luminosity to 105 units.

The lecture, which was accompanied by a number of beautiful experiments, was attentively followed by a large and appreciative audience.

Mr. John Ellershaw, who has been Chairman of the Magistrates' Gas Committee at Leeds from the time the Corporation took over the gas-works from the Leeds Gaslight Company and the Leeds New Gas Company in 1870, died last Sunday week. The deceased gentleman was in his 76th year.

Inclined Retorts.—With regard to the right to use inclined retorts on the system covered by M. André Coze's patents, we learn that arrangements have been made by Mr. Alfred Kitt, of The Gaslight and Coke Company, for the transfer of all his interest in his patent No. 14,881, of 1889, to the Automatic Coal-Gas Retort Company, Limited, who claimed that Mr. Kitt's patent was already covered by those owned by them.

SELF-LOCKING GAS-COCKS.

A novel and ingenious method of securing gas-cocks from undue interference has been invented by Messrs. Harrison and Sheard, of Salford, who have applied for patent protection for the same.* The invention is designed to fulfil two distinct purposes: First, to enable a cock to be closed and securely fastened, so that it cannot subsequently be opened, and gas thereby obtained through it, without the consent of the person responsible for locking it; and, secondly, to provide a simple and cheap form of regulator, by enabling the plug of the cock to be locked or secured in any position of its travel from "fully open" to "closed." In the first form, it is intended chiefly for the use of gas companies and corporations, that their control over the supply of gas may be made more efficient, and at the same time more economical than at present; in the second, it will give the gas consumer a better command over the disposal of the gas he purchases, as he can open or close his cock to any desired extent, and there secure it, without fear of its being altered except with his knowledge or consent.

The invention applies to plug cocks, in which the plug is moved to open or close the cock by means of a moveable key or spanner, fitting on to the squared head of the plug. This is the class of cock usually employed as a main cock to control the supply of gas at the entrance to the consumer's meter. When the supply of gas to a consumer is to be discontinued, either through removal, ceasing to burn gas, or non-payment of account, it is requisite to take some steps to prevent fraudulent consumption or inadvertent waste of gas; and the usual method of accomplishing this object is to remove the meter, take off the main cock, and plug up the end of the service-pipe. This is obviously an expensive procedure; both by reason of the labour it entails and the injury to which the meter is liable by being moved about. It is this expense which the self-locking cock, in its first form, is intended to prevent; by enabling the cock to be closed, and securely fastened by the gas company's officer, without risk of its being opened except with his consent. For this purpose, the key or spanner for opening or closing the cock is provided on its under side with a small stud or pin projecting therefrom; while the boss of the key, being somewhat deeper than in the ordinary form of key, the extra depth is hollowed out on its upper side, so as to form a circular recess or hollow, for a purpose which will be afterwards explained.

The method of locking or securing the cock may now be described. In an ordinary plug cock, the plug is prevented from describing more than half a circle, and so being turned beyond the point at which the cock is closed, in the following manner: The barrel of the cock, at its upper part, is cut away for a short distance on half its circumference, and in the hollow thus formed a projecting pin or stud on the periphery of the plug travels to and fro; the plug being thus stopped from turning at the two extreme points where the pin or stud comes in contact with the uncut portion of the barrel—the cock being closed when the plug is in either of these two positions. If, then, it is required to lock the cock when closed, this is done by placing the key or spanner on the head of the plug in such a manner that the stud or projection on its under side is in contact with the uncut part (already described) of the barrel of the cock at the opposite point on its circumference to that at which the pin or stud on the plug of the cock is itself in contact. Thus the plug is prevented from turning in one direction by its own stud; and, in the other direction, by the stud on the under side of the key or spanner. A thin metal plate is then placed in the previously described hollow recess on the boss of the key, and held firmly down upon the head of the plug by means of a small screw. The metal plate and screw are afterwards either covered with wax and sealed, or protected by a cover and secured by a padlock, as may be preferred, in such a manner that the key or spanner cannot be removed or interfered with without the seal being broken or the padlock opened. The whole process, difficult as it is to describe, is extremely simple, and the arrangement most inexpensive. When the need for locking the cock is past, the key is available for opening and closing the cock in the ordinary manner, by inverting its position on the head of the plug.

In the second form of self-locking cock—that, namely, of a regulator—the key or spanner differs from that above described in having no projecting stud, while the boss of the key, beneath the hollow recess, is perforated by two slots concentric to the opening for fitting on to the head of the plug. The pin or stud on the plug of the cock is also dispensed with; its place, as well as that of the stud on the underside of the key, being taken by two ears or projections on the metal plate fitting in the hollow recess on the boss of the key; which ears pass through the slots above mentioned, and abut against the uncut portion of the barrel of the cock. When the metal plate is not screwed firmly down, the key or spanner is free to open or close the cock as desired; but when held down on the head of the plug, by means of the screw, the key is maintained in the position at which it has been "set," and cannot be moved therefrom without first undoing the screw, which latter may be protected from interference either by sealing or a padlock as before described.

* Specimens of these gas-cocks have been forwarded by the inventors to the JOURNAL Offices, where anyone interested may see them.

THE EFFICIENCY OF GAS-ENGINES.

(*Concluded from p. 1096*)

At the Paris meeting of the Institution of Mechanical Engineers in July last year, a paper descriptive of the "Simplex" gas-engine was read by M. Delamare-Debouteville, who recorded certain tests conducted by Dr. Witz with a "Simplex" engine having a cylinder 7⅞ inches in diameter with a stroke of 15¾ inches, working at a normal speed of 160 revolutions per minute. At the first trial, in November, 1885, the engine developed 6·70-horse power at the brake, with a mean consumption of 22·09 cubic feet of gas per brake horse power per hour; or, allowing for the temperature and pressure of the gas passing the meter, 21·55 cubic feet per brake horse power per hour at standard temperature and pressure. As the heating value of the gas used was 607 British thermal units, this gives an expenditure of 13,080 units per brake horse power per hour, distributed as follows: Converted into work at the brake, 19·4 per cent.; abstracted by cooling water, 30·5 per cent.; rejected in exhaust, and absorbed in overcoming the friction of the engine, 50·1 per cent. In the second trial the engine developed 8·67-horse power at the brake, with a mean consumption of 20·66 cubic feet per horse power per hour; or, allowing for the temperature and pressure of gas at the meter, 20·12 cubic feet per brake horse power per hour. This gives an expenditure of 12,212 thermal units per brake horse power per hour, made up as follows: Converted into work at the brake, 20·9 per cent.; abstracted by cooling water, 41·4 per cent.; rejected in exhaust and absorbed in overcoming friction, 37·7 per cent. The theoretical efficiency of this engine works out to about 0·40.

The "Forward" engine, which is made by Messrs. Barker and Co., of Birmingham, and is of the three-cycle type, having one impulse every three revolutions, was tested in June, 1888, by Professor R. H. Smith. In the engine tested, the cylinder was 7·326 inches in diameter, with a stroke of 15·10 inches. At a mean speed of 176·86 revolutions per minute, the engine indicated 5·54-horse power and developed 4·807-horse power at the brake; the total gas consumpton being 115·2 cubic feet per hour, or at the rate of 20·79 cubic feet per indicated horse power per hour, and 23·97 cubic feet per brake horse power per hour, neglecting the ignition gas, which was consumed at the rate of 1·574 cubic feet per hour. From an analysis of Birmingham gas by Dr. Frankland, I find the calorific power per cubic foot at the standard temperature and pressure, to be 639 British thermal units, which gives an expenditure of 13,284 units per indicated horse power per hour, distributed as follows: Converted into work, 19·2 per cent.; abstracted by cooling water, 40·7 per cent.; rejected in exhaust, &c., 40·1 per cent. The efficiencies work out as follows: Absolute efficiency, 0·192; theoretical efficiency, 0·35; mechanical efficiency, 0·867.

The "Ajax" engine, which is made by the Glasgow Gas-Engine Company, is constructed on the two-cycle system, having an impulse every two revolutions. In March, 1889, Professor Jamieson conducted a test at Glasgow of a 6-horse power nominal engine, having a cylinder 8 inches in diameter with 15-inch stroke. At a mean speed of 173·5 revolutions per minute, the engine indicated 10·04-horse power, and developed 8·84-horse power at the brake, with a total consumption of 189·6 cubic feet of gas per hour, neglecting that used for the igniting flame. This gives a mean consumption of 18·9 cubic feet of gas per indicated horse power per hour, and 21·5 cubic feet per brake horse power per hour. From an analysis of Glasgow gas by Dr. Frankland, the calorific power is found to be 813 British thermal units per cubic foot at standard temperature and pressure, which gives an expenditure of 15,366 thermal units per indicated horse power per hour. The efficiencies of the engine work out as follows: Absolute efficiency, 0·166; theoretical efficiency, 0·37; mechanical efficiency, 0·879.

The Fawcett engine, which is manufactured by Messrs. Fawcett, Preston, and Co., of Liverpool, is similar to the Clerk engine, in that it is fitted with a separate cylinder for taking in the charge of gas and air, and delivering it to the motor cylinder, and that it has an impulse every revolution. The chief point of difference, however, lies in the fact that in the Clerk gas-engine the charge was simply delivered into the motor cylinder by the displacer piston; while in the Fawcett engine the charge is compressed between the pistons of the motor and compression cylinders—the latter piston being slightly in advance of the motor piston, so as to allow of the valve communicating between the cylinders being closed before the ignition of the charge. Amongst other tests of these engines, I conducted a series of trials on a 6-horse power nominal engine on Feb. 22, 1890. The diameter of the motor cylinder was 8 inches, and that of the compressor cylinder 6½ inches—both having a stroke of 15⅝ inches. At a mean speed of 150·8 revolutions per minute, the engine indicated 11·49-horse power net, and developed 8·52-horse power at the brake, with a total gas consumption of 210·8 cubic feet per hour, neglecting that used for ignition purposes. This gives a mean consumption of 18·4 cubic feet per indicated horse power per hour, and 24·74 cubic feet per brake horse power per hour. The calorific value of the gas used was 770 British thermal units per cubic foot at the standard temperature and pressure. Correcting this for the temperature and pressure of the gas passing the meter (68° Fahr. and 1·77 inches of water), the calorific value of the gas becomes 711 units per cubic foot. The actual amount of heat supplied to the engine was 13,012 thermal units per indicated horse power per hour, distributed as follows: Converted into work, 19·6 per cent.; abstracted by cooling water, 49·9 per cent.; rejected in exhaust, 30·5 per cent. From an analysis of the indicator diagrams, the value of the co-efficient k, for the expansion curve, was found to be 1·401—a value which brings the curve somewhat below the adiabatic. The efficiencies work out as follows: Absolute efficiency, 0·196; theoretical efficiency, 0·41; mechanical efficiency, 0·741.

Of the second type of Class III., or engines in which the volume of the gases after expansion is greater than the original volume, only one case—the Atkinson engine—will be referred to. The chief peculiarity of this engine is the very ingenious arrangement of link-work whereby the plunger makes two double-strokes of unequal length at each revolution. Starting with the plunger at the end of the cylinder, after the products of combustion have been expelled, the piston makes a short forward stroke, during which it draws in its supply of gas and air, and a somewhat shorter back stroke, during which the mixture is compressed. Ignition is then effected, and the piston makes a long expansion stroke, followed by a long return stroke, which expels the products of combustion. The complete cycle is therefore performed in one revolution of the engine and in a single cylinder. In April, 1887, Professor Unwin tested a 4-horse power nominal Atkinson engine at Gospel Oak, London, having a cylinder 7½ inches in diameter, with a compression stroke of 5½ inches and an expansion stroke of 9¼ inches. At a mean speed of 147·8 revolutions per minute, the engine indicated 5·563-horse power, and developed 4·889 brake horse power, with a total gas consumption of 110·04 cubic feet of gas per hour, neglecting that used for the igniting flame. This gives a mean consumption of 19·78 cubic feet per indicated horse power per hour, and 22·51 cubic feet per brake horse power per hour. Assuming that the gas used was similar to that used at the Society of Arts trials, and that the temperature of the gas was the same as that of the workshop (55° Fahr.), the calorific value per cubic foot, corrected for temperature, becomes 604 British thermal units. The supply of heat to the engine, for the production of one indicated horse power per hour, is therefore 11,704 thermal units, which is expended as follows: Converted into work, 21·9 per cent.; abstracted by cooling water, 19·08 per cent.; rejected in exhaust, &c., 59·02 per cent. The value of k, for the curve of expansion, was 1·305, which brings the curve above the adiabatic; showing that the heat developed during expansion was in excess of that carried away by the cooling water. The efficiencies of this engine are as follows: Absolute efficiency, 0·219; theoretical efficiency, 0·45; mechanical efficiency, 0·879.

The Atkinson engine tested at the Society of Arts trials was of 6-horse power nominal, having a cylinder 9½ inches in diameter, with a suction stroke of 6·33 inches, a compression stroke of 5·03 inches, a working stroke of 11·13 inches, and an exhaust stroke of 12·43 inches. At a mean speed of 131·1 revolutions per minute, the engine gave, when working at full power, 11·15 indicated horse power, and developed 9·48-horse power at the brake. The total gas consumption, including 4½ cubic feet for ignition, was 214·3 cubic feet per hour. This gives a mean consumption of 18·82 cubic feet per indicated horse power per hour, and 22·14 cubic feet per brake horse power per hour, neglecting ignition gas; or 19·22 cubic feet per indicated horse power per hour, and 22·61 cubic feet per brake horse power per hour, including the gas required for igniting purposes. The calorific power of the gas used was 633 British thermal units per cubic foot at the standard temperature and pressure; or, allowing for the temperature and pressure of the gas passing the meter, 597·4 units per cubic foot. The actual expenditure of heat was, therefore, at the rate of 11,250 thermal units per indicated horse power per hour, distributed as follows: Converted into work, 22·8 per cent.; abstracted by cooling water, 27 per cent.; rejected in exhaust, lost by imperfect combustion, &c., 50·2 per cent. The value of the co-efficient k, for the curve of expansion, was 1·264, which brings the curve considerably above the adiabatic; showing the heat developed during expansion to be in excess of that abstracted by the cooling water, and pointing to incomplete combustion. The efficiencies of the engine work out as follows: Absolute efficiency 0·228; theoretical efficiency, 0·48; mechanical efficiency, 0·85. In the half-power trial, the engine, running at a mean speed of 129·6 revolutions per minute, indicated 6·59-horse power, and developed 4·74-horse power at the brake, with a total gas consumption of 133 cubic feet per hour, including 5·9 cubic feet for ignition purposes. This gives a mean consumption of 19·29 cubic feet per indicated horse power per hour, and 26·80 cubic feet per brake horse power per hour, neglecting the ignition gas, or 20·18 cubic feet per indicated horse power, and 28·10 cubic feet per brake horse power, including the gas for ignition purposes. Taking the calorific power of the gas as in the previous case, the expenditure of heat per indicated horse power per hour comes out as 11,523 thermal units, the distribution of which was as follows: Converted into work, 22·3 per cent.; abstracted by cooling water, 23·2 per cent.; rejected in exhaust, &c., 54·5 per cent. The efficiencies work out as follows: Absolute efficiency, 0·223; theoretical efficiency, 0·48; mechanical efficiency, 0·719.

As Mr. Brightmore, in his paper on the "Application of Atmospheric Air to Produce Motive Power," referred to the Hargreaves motor, I have thought that a comparison of its performance with that of the foregoing engines might be of interest.

This engine, which belongs to the second division of the system of classification I have adopted, is at present arranged to burn coal tar or creosote as fuel, although there is no reason why coal gas should not be used for the purpose—indeed, Mr. Hargreaves covers the use of gas in his patent. The engine, in its simplest form, consists of an air-compressing pump and motor cylinder; the latter being provided with a regenerator which absorbs a portion of the heat of the exhaust gases and gives it up again to the incoming charge. The motion work between the motor cylinder and the crank-shaft is of the usual description, and does not call for any special remark. The cycle of operations is as follows: Air is compressed in the air-compressing pump, and delivered through the regenerator into the motor cylinder, where it meets a jet of coal tar, creosote, or (for that matter) coal gas. The air being already heated to redness by its passage through the regenerator, combustion takes place, and the air expands under constant pressure until the supply is cut off, after which the pressure falls gradually to the end of the stroke, when the exhaust valve is opened, and the products of combustion are delivered through the regenerator into the atmosphere; the temperature of the exhaust gases, as they pass the regenerator, being from 300° to 360° Fahr. In the larger engines, steam is generated in the water-jacket, and passed through the regenerator into the motor cylinder, where, in addition to increasing the volume of the working fluid and moderating the intense temperature produced by combustion, it adds its pressure to that of the air. In March, 1890, some experiments were made with an engine having an air-compressing cylinder 15 inches in diameter, and a motor cylinder 25 inches in diameter, both having a stroke of 18 inches. At a mean speed of 100 revolutions per minute, the motor cylinder, with an initial pressure of 56 lbs. per square inch, developed 63 indicated horse power, of which the air-compressing pump absorbed 23 indicated horse power; giving a net indicated horse power of 40. The fuel used was coal tar, and the total consumption per hour was 2 gallons, or 20·5 lbs.; giving a mean consumption of 0·512 lb. per indicated horse power per hour. From analysis, the coal tar used had a calorific power of 15,941 British thermal units per pound, or about 7 per cent. greater evaporative power than good Welsh coal. The actual heat supplied to the engine per indicated horse power per hour thus becomes 8162 thermal units. The efficiencies work out as follows: Absolute efficiency, 0·314; theoretical efficiency, 0·635.

In another experiment, on a smaller engine, having an air-compressing cylinder 8 inches in diameter with a stroke of 10¾ inches, and a motor cylinder 11 inches in diameter with a stroke of 10 inches, the indicated horse power, developed by the motor cylinder, with an initial pressure of 31·25 lbs. above the atmosphere, and a mean speed of 170 revolutions per minute, was 8·1, of which the air-compressing pump absorbed 2·93 indicated horse power; thus giving a net indicated horse power of 5·17. The fuel used was creosote, of which 5 pints, or 6·25 lbs., was used per hour; giving a mean consumption of 1·2 lbs. per indicated horse power per hour. From analysis, the calorific value of the creosote was found to be 14,835 British thermal units per pound. The expenditure of heat for the production of an indicated horse power is thus found to be 17,702 thermal units. The efficiencies of the engine work out as follows: Absolute efficiency, 0·144; theoretical efficiency, 0·65. The theoretical efficiency in both these trials is calculated on the assumption that the maximum temperature is 2500° Fahr., and that the maximum temperature of the products of combustion, as they leave the regenerator, is about 300° Fahr.

For the purpose of comparison, I append a table giving the principal results of the engine tests referred to in the foregoing paper. When alluding to the loss of heat through the cylinder walls, I stated that the loss depended: (1) Upon the difference of temperature between the gas in the cylinder and the water in the jackets; (2) upon the extent of the surfaces exposed to the heated gases and the cooling water—the volume of the gases remaining the same; and (3) upon the time the gases were in contact with the cylinder walls. Of these conditions the latter will possibly have the greatest effect on the transfer of heat from the gases in the cylinder to the cooling water, as, with the exception of the Lenoir and Hugon engines, the proportion of surface to volume, and the temperature of the cooling water, do not vary to a sufficient extent to greatly affect the results in practice. I have therefore given in the table the duration of the expansion stroke in seconds, an inspection of which will clearly show the tendency of the percentage of heat absorbed by the jacket water to rise as the duration of the expansion stroke increases. The line giving the product of the percentage of heat absorbed by the jacket water divided by the duration of the expansion stroke, shows much more clearly the effect of time on the transfer of heat through the cylinder walls. The table indicates clearly, without further explanation, the relative value of the different types of gas-engines from a thermo-dynamic point of view. It may, however, be of interest to compare these results with those obtained from the best steam-engine practice. The expenditure of heat in the Paxman compound high-pressure engine, tested at the Society of Arts trials, was at the rate of 20,850 thermal units per indicated horse power per hour; the initial pressure being 176·6 lbs. per square inch. This gives an absolute efficiency of 0·123. Mr. Mair, in his paper on "The Independent Testing of Steam-Engines," gives the results of the tests of a compound receiver beam-engine, with jacketed cylinder, using steam at an absolute pressure of 76 lbs. per square inch, in which one indicated horse power per hour was obtained for an expenditure of 17,460 heat-units. This gives an absolute efficiency of 0·146.

In the "Meteor" trials conducted by a Committee of the

Type of Engine	Lenoir.		Hugon.		Brayton.	Otto.						Clerk.		
Testers (see below)	(a)	(a)	(a)	(b)	(c)	(d)	(e)	(f)	(f)	(f)	(g)	(h)	(h)	(h)
Indicated horse power	—	—	3·55	1·17	5·00	5·04	9·60	3·42	22·56	33·60	17·12	3·62	9·05	27·46
Brake horse power	0·56	0·88	2·07	—	3·96	4·40	8·10	2·87	18·31	27·75	14·74	2·70	7·23	23·21
Cub. ft. gas p. I.H.P. p. hour	—	—	53	—	55·20	28·3‡	24·50	30·90	23·60	25·04	20·55‡	29·80	24·30	20·39
Do. p. B.H.P. p. hour	112	97	90·930	73·50	69·30	32·4‡	25·10	33·40	29·10	30·30	23·87‡	40	30·42	24·12
B.T. units p. I.H.P. p. hour	—	—	35,720	45,862	34,168	15,536	15,118	19,745	15,080	16,000	12,120§	24,227	19,756	16,495
Do. p. B.H.P. p. hour	—	—	66,106	—	42,896	17,810	17,957	21,342	18,594	19,201	14,093§	32,520	24,731	19,609
P. ct. heat turned into work	—	4*	7·10	5·50	7·50	16·00	17·00	14·46	17·15	16·15	21·20	10·50	12·90	15·50
Do. abstracted by jacket	53	69	43·70†	—	—	51·00	52·00	—	—	—	43·20	—	—	—
Do. rejected in exhaust.	—	27	10·90	—	—	33·00	31·00	—	—	—	35·60	—	—	—
Absolute efficiency	—	—	0·071	0·055	0·075	0·16	0·170	0·1446	0·1715	0·1615	0·212	0·105	0·129	0·155
Theoretical efficiency	—	—	0·256	0·258	0·300	0·33	0·330	0·33	0·33	0·33	0·410	0·360	0·360	0·36
Mechanical efficiency	—	—	0·580	—	0·793	0·87	0·843	0·84	0·81	0·826	0·860	0·755	0·799	0·845
Revolutions per minute	129	100	53·01	85	—	157·70	158	160·30	158·70	151·37	160·10	212	146	132
Piston speed per minute	86	79·1	112·20	166·40	—	351	369	320·60	423·20	529·70	480·30	308	292	440
Duration of expansion stroke in seconds	1/4·3	1/3·3	1/7·6	1/2·8	—	1/5·2	1/5·2	1/5·3	1/5·3	1/5·2	1/5·30	1/7	1/4·86	1/4·4
Heat abstracted by jacket divided by duration of expansion stroke in seconds	228	228	77	—	—	265	270	—	—	—	229	—	—	—

Type of Engine.	Beck.		Griffin.			Simplex.		Forward.	Ajax.	Fawcett.	Atkinson.		Hargreaves.	
Testers (see below)	(i)	(i)	(j)	(i)	(g)	(k)	(k)	(l)	(j)	(m)	(n)	(g)	(o)	(o)
Indicated horse power	7·35	6·12	17·28	17·46	15·47	—	—	5·540	10·04	11·49	5·536	11·15	40	5·17
Brake horse power	5·71	4·84	13·60	14·94	12·51	6·70	8·67	4·807	8·84	8·52	4·889	9·48	—	—
Cub. ft. gas p. I.H.P. p. hour	21·18	20·67	19·27‡	18·92‡	22·64‡	—	—	20·79‡	18·90‡	18·40‡	19·780‡	19·220‡	—	—
Do. p. B.H.P. p. hour	27·27	26·14	24·48‡	23·58‡	28‡	21·55‡	20·12‡	23·97‡	21·50‡	24·74‡	22·510‡	22·610‡	—	—
B.T. units p. I.H.P. p. hour	12,290§	12,092§	12,313§	12,089§	13,380§	—	—	13,284	15,366	13,082§	11,704§	11,250§	8,162	17,702
Do. p. B.H.P. p. hour	15,953§	15,292§	15,642§	15,067§	16,538§	13,080§	12,212§	15,316	17,479	17,590§	13,596§	13,507§	—	—
P. ct. heat turned into work	20·70	21·10	20·80	21·20	19·20	19·40*	20·90*	19·20	—	19·60	21·90	22·80	31·40	14·40
Do. abstracted by jacket	33·60	33·40	32·40	39·70	35·20	30·50	41·40	40·70	—	49·90	19·08	27	—	—
Do. rejected in exhaust.	47·30	47·10	46·80	43·10	45·60	50·10	37·70	40·10	—	30·50	59·02	50·20	—	—
Absolute efficiency	0·207	0·211	0·208	0·229	0·192	—	—	0·192	0·166	0·196	0·219	0·228	0·314	0·144
Theoretical efficiency	0·340	0·340	0·380	0·38	0·380	0·40	0·40	0·350	0·370	0·410	0·450	0·480	0·635	0·650
Mechanical efficiency	0·779	0·790	0·787	0·856	0·809	—	—	0·867	0·879	0·741	0·879	0·850	—	—
Revolutions per minute	212	168·90	183	223·80	198·10	160	160	176·86	173·50	150·80	147·30	131·10	100	170
Piston speed per minute	530	422·80	427	522	420·50	420	420	435	433·70	400·50	467‖	500·80‖	300	291·60
Duration of expansion stroke in seconds	1/7	1/5·6	1/6·1	1/7·46	1/6·6	1/5·3	1/5·3	1/5·8	1/5·8	1/5	1/9·6	1/8·80	—	—
Heat abstracted by jacket divided by duration of expansion stroke in seconds	235	187	197·60	296	232	161·5	219	244	—	249·50	183	237	—	—

Names of Testers.—(a) Trésca; (b) Clerk; (c) Thurston; (d) Slaby; (e) Brooks and Steward; (f) Adams; (g) Society of Arts Committee; (h) Garrett; (i) Kennedy; (j) Jamieson; (k) Witz; (l) R. H. Smith; (m) Miller; (n) Unwin; (o) Bird.

* Work developed at brake. † Including 23·60 per cent. for evaporating injection water in cylinder.

‡ Neglecting the gas used for ignition purposes. § Corrected for temperature and pressure of gas passing meter ‖ Piston speed during explosion stroke.

Institution of Mechanical Engineers, the engines, which were of the triple-expansion type, working with a boiler pressure of 145 lbs. per square inch, developed one indicated horse power per hour for an expenditure of 15,936 thermal units. This gives an absolute efficiency of 0·16. Compared with an engine of the Atkinson type, as tested by the Society of Arts Committee, the triple-expansion steam-engine referred to has an economy, from a thermo-dynamic standpoint, of only 0·706; while compared with the Hargreaves engine its economy is but 0·51. When, however, we come to consider the relative value of steam and gas engines from a financial point of view, the above figures speedily undergo a change; as, owing to the high price of the ordinary coal gas used for illuminating purposes compared with that of coal, the economy of working soon ceases to be in favour of the gas-engine. Thus, taking gas at 3s. per 1000 cubic feet, and coal at 15s. per ton, the cost of fuel for the gas-engine, when burning 20 cubic feet of gas per indicated horse power per hour, would just equal that for a steam-engine burning 9 lbs. of coal per indicated horse power per hour. Of course, the reduced attendance required for the gas-engine would bring down the actual working expenses of the gas-engine as compared with the steam-engine. The foregoing comparisons are made on the assumption that ordinary coal gas is used as fuel. If, however, the engine be worked with a cheap fuel gas, made by a special apparatus, the figures will be greatly reduced. Thus, Messrs. Crossley guarantee a consumption not exceeding 1¼ lbs. of gas coke per hour when the Dowson gas-producer is used with their engines.

In an appendix to his paper, the author gave the following data used in the calculations made in preparing it: Specific heat of air at constant volume, 0·169 British thermal unit; specific heat of air at constant pressure, 0·238 unit; weight of 1 cubic foot of air at standard temperature and pressure, 0·075 lb. One British thermal unit has been taken as equal to 772 foot-pounds. In determining the thermal value of the various gases, it has been assumed that, burning completely in oxygen, the calorific values are as follows: Hydrogen, 52,200 units; marsh gas, 21,510 units; olefiant gases, &c., 20,100 units; carbonic oxide, 4350 units. Annexed to the appendix was a plate of theoretical and actual diagrams obtained from engines representing the three types of the system of classification adopted.

Electric Lighting at Leeds.—The *Leeds Mercury*, complaining about the electric lighting at the Town Hall, says: "Somehow the dynamo gets lame in its supply. Two or three of the lamps catch the current and give forth a small solar blaze, but the others are as dark as the moon on the obscure side."

The Subsidences of Land at Northwich.—Last Thursday, there was an alarming subsidence at Northwich. The Dane, which empties itself into the Weaver near Northwich, overflowed its banks, and caused a serious subsidence on the Chester main road. About 30 or 40 yards of the thoroughfare have gone in, carrying away the gas and water pipes, and leaving an immense hole, which will require to be filled up before traffic can be resumed.

Proposed Purchase of the Lisburn Water-Works by the Town Commissioners.—The water-works at Lisburn are the property of Lord Hertford; and from time immemorial, it is said, the Hertford family have provided the town with a copious supply of water. Some time ago the Town Commissioners, as the sanitary authority, made overtures for the purchase of the works; but the sum named by the agent (£15,000) was regarded as too high, and the matter dropped. Hearing that a Belfast syndicate were negotiating with a view to getting the water supply into their hands, the Town Commissioners have once more entered into negotiations; and it is understood that the transfer is now likely to be satisfactorily arranged, as the Commissioners are willing to submit the matter to arbitration.

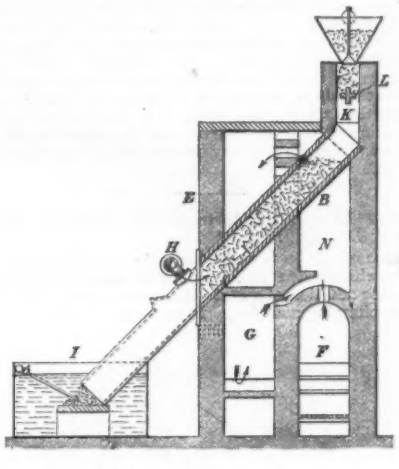
Portsmouth Water-Works Company.—At the recent half-yearly meeting of this Company, the Chairman (Lieut.-Col. E. Galt) presented a report on the past half-year's working, which showed that the revenue had amounted to £23,166; that the available balance on the profit and loss account was £15,735; and that, after the payment of the usual statutory dividends, there would be a balance of £1900 to be carried forward. The Chairman, in moving the adoption of the report, said that the works were in good order. There had been a plentiful supply of water, and the springs were yielding well. There was, however, one question which they would have soon to consider; and that was with respect to the fittings, which were to be used to prevent waste in the present constant supply. The Engineers had reported that there was waste going on in thousands of the fittings, which greatly diminished the pressure throughout the borough. The report was adopted.

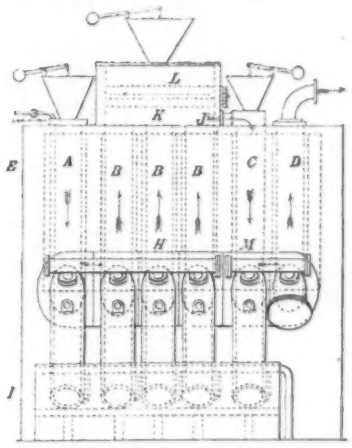
The Arbitration Respecting the Dublin Public Lighting Plant.—The award of the Arbitrators (Mr. H. E. Jones, M. Inst. C. E., Engineer of the Commercial Gas Company, and Mr. R. Hamilton, Superintendent of Public Lighting, Glasgow) in the proceedings instituted a short time ago—see *ante*, p. 857—to determine the price to be paid by the Corporation of Dublin for the public lighting plant in the city, which they have taken over from the Alliance Gas Company, has just been given. It may be remembered that the Company asked £16,777 for the plant; this being its cost price, including erection. The Corporation, on the other hand, valued it at only £2700—a very material difference; their three witnesses giving evidence to the effect that, so far as the lamps (3800 in number) were concerned, they were valueless. The Company submitted that they were entitled to the cost of the plant, and that if the Arbitrators considered there should be any deduction for depreciation, it should be very small. It is clear that these gentlemen held a similar opinion; for they have awarded the Company £14,341. The Umpire (who does not appear to have been appealed to) was Mr. R. Mitchell, of Edinburgh.

REGISTER OF PATENTS.

Manufacture of Illuminating Gas.—Jones, F. J., of St. Albans No. 19,721; Dec. 7, 1889. [8d.]

This invention relates to the continuous manufacture of illuminating gas, which formed the subject of another patent, dated July 20, 1889, No. 11,624. According to this process, the hot gas resulting from the decomposition of steam (water gas) is caused to pass completely through a column of coal in an externally-heated retort so arranged that the charge will descend therein by gravity; the water gas mixing with the gases and tarry vapours distilled from the coal, and the mixed gases and vapours being immediately superheated in order to convert the condensable constituents of the gases and vapours into permanent gas.





In fig. 1 (a cross-section) and fig. 2 (a front elevation), A is a water-gas generator; B are the retorts in any suitable number; C and D are superheaters; F is the furnace for heating the water-gas generator and retorts; and G is a regenerator for heating the air supplied to the combustion chamber. A, B, C, and D, are fire-clay tubes set in an inclined position in a brick setting, through the front wall of which the lower ends of the several tubes project; the water-gas generator A and the retorts B being all in communication at the upper side of their lower forward extensions by a cross-pipe or main H. The lower ends of the generator and retorts have tubular cast-iron prolongations, extending downwards beyond the point of connection with the main H; and their open lower ends are sealed by dipping into a water-tank I, wherein they terminate just above a slab, which supports the ash, and prevents the too-rapid descent of the superincumbent charge contained in the generator and retorts, and from which the ash is removed as necessary to allow of the gradual descent of the charge.

The water-gas generator A and retorts B are so set that the contained charge will descend therein by gravity; and the former is provided at the top (above the setting E) with a charging hopper closed by a cone, and with a steam-inlet pipe just below the charging mouth. It is charged with anthracite coal, or else coke or charcoal. The retorts B are of gradually-increasing cross-sectional area towards the lower end, so as to allow of the swelling of the charge under distillation, and permit it to descend freely; plugged holes being provided for the insertion of a tool, should any wedging occur. The retorts communicate at the upper end with a charging throat K, preferably common to all the retorts, and rising above the setting, and being surmounted by a charging hopper closed by a cone. A revolving winged feed-drum L is mounted in the throat, whereby the coal fed in through the hoppers is distributed to the retorts in regulated quantities. The throat is connected by a pipe J, at a point below the feed drum, with the upper end of the first superheater C, which is inclined like the retorts B, and is provided at the top with a charging hopper and cone; while its lower end is sealed by dipping into the tank I. The superheater is charged with inert porous substances—such as coke or broken bricks; and its lower extension communicates by a cross-tube or main M with the lower end of the second superheater D. The latter is filled with broken brick, is closed at the lower end, and is connected at the upper

end with the ordinary purifier or directly to the gasholder, as the case may be.

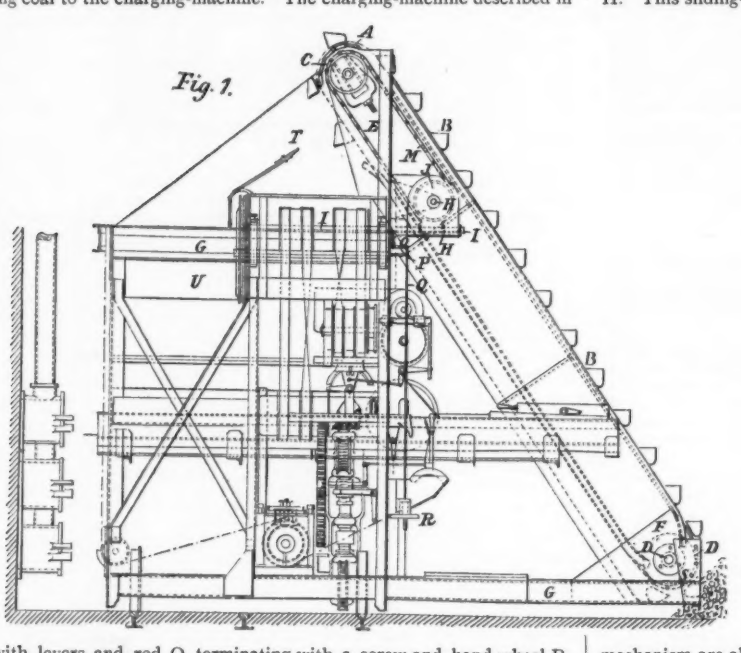
The generator A, retorts B, and superheaters C and D, traverse a combustion chamber N, which is partially separated from the furnace F by an arch having apertures through which the carbonic oxide generated in the furnace enters the combustion chamber N. The regenerator G also communicates with the combustion chamber N just above the arch, and serves to heat the air admitted thereto for effecting the combustion of the furnace gases; and it is itself heated by the escaping products of combustion after they have circulated around, and so heated, the retorts, &c.

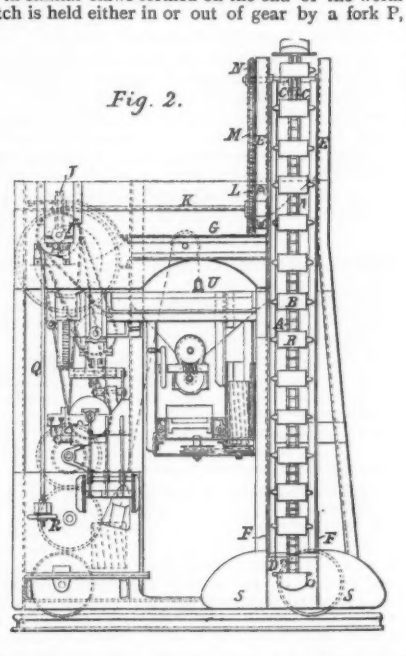
If the gas requires to be enriched, an inlet-pipe may be provided at the upper end of the first superheater C, at which petroleum, tar, or other liquid hydrocarbon may be injected for the purpose. In this case it is preferable to use coke in the first superheater C; and it is necessary, to prevent choking by the deposit of carbon therein, that the coke should be renewed from time to time, which is done by charging fresh coke in at the top, and withdrawing a portion of the contents at the bottom as often as necessary. The water gas continuously generated in A passes at once, in a heated state, through the main H into the retorts B, wherein it mixes with the gaseous products of distillation—the resulting mixture of gases and vapours passing at once (before being allowed to cool down) through the superheaters C and D, in the former of which the gas may be enriched, if necessary, as above mentioned.

Machinery for Charging Retorts.—West, John, of Manchester. No. 20,551; Dec. 21., 1889. [6d.]

This invention relates to improvements in machinery for charging gas-retorts for which patent No. 723 of 1888 was granted;* and it has for its object the addition of a coal elevator for picking up and supplying coal to the charging-machine. The charging-machine described in the 1888 patent received its supply of coal from overhead fixed hoppers placed in convenient positions in the retort-house, and fed by fixed coal elevators. But, in the present invention, it is proposed to combine a coal elevator with the travelling charging-machine, and arrange the elevator to pick up the coal from the floor of the retort-house or coal-store, either while the charging-machine is travelling or stationary. The coal is elevated and delivered to the hopper carried by the charging-machine; being guided to the hopper during delivery by a shoot, or by guide-plates arranged to distribute the coal in the hopper. Fig. 1 represents a side elevation of the elevator and machine for charging the retorts; and fig. 2, an end elevation of the machine.

The elevator is arranged at an angle for picking up and delivering the coals; and it consists of an endless band or chain A, to which coal-buckets B are attached, and spaced at suitable distances apart. The elevator chain with the buckets works round pulleys C and D; the pulley C being at the top end of the elevator, and the pulley D at the lower end. The pulleys are fitted to shafts C^1 and D^1 carried by bearings and standards E and F fixed to, and supported by, the main framework G of the charging-machine. The elevator is driven by gearing, belts, or chains worked by any of the shafts, which are set in motion by the main driving gear of the charging-machine; or it can be driven by a separate motor fixed in any convenient position on the machine, and the gear can be arranged to be thrown in and out of gear by a clutch with levers or screws. The arrangement shown for driving is by a screw worm H, fitted on the end of the shaft I, which is set in motion by the main driving gear of the machine. The worm gears into and drives a worm-wheel J keyed to the shaft K, at the end of which shaft is keyed a chain-wheel L, driving a chain M and chain-wheel N, keyed to the shaft C^1, which drives the pully C, the chain A, and the buckets B. The worm H is not directly set in motion by the shaft I, but by a sliding clutch O keyed to the shaft, and provided with claws to engage in similar claws formed on the end of the worm H. This sliding-clutch is held either in or out of gear by a fork P,





with levers and rod Q, terminating with a screw and hand-wheel R. To the bottom of the elevator is attached a special feeder in the form of one or more plough breasts S, fixed in a position in advance of the elevator, when the machine is travelling. These plough breasts are for the purpose of cutting through the coal and feeding it to the elevator buckets B. After the coal is elevated, it is delivered to guide-plates or shoots T, which will distribute the coal in the hopper U of the charging-machine.

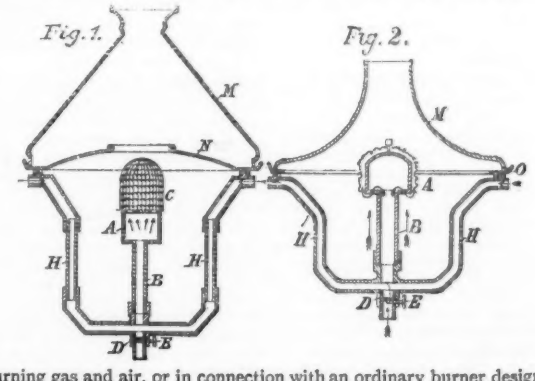
Water-Meter.—Schinzel, E., of Naples. No. 20,676; Dec. 23, 1889. [8d.]

This water-meter comprises a cylindrical outer case of cast iron, divided into two compartments; the lower one of a smaller diameter than the upper. The lower division is entirely closed; and an iron cover carrying a thick glass plate encloses the upper compartment. An inner casing of ebonite or hard rubber is fitted within the iron box, and is also divided into two compartments with a division plate of similar material between the two, through the centre of which passes the axle of a paddle-wheel, working in the lower compartment, and supported by a step bearing at the lower end of the axle. Between the inner casing and the outer box, an annular space is provided, which receives the water from the inlet-pipe, and communicates with the lower compartment by oblique passages in the wall, so placed that the water on entering meets the paddles or vanes of the wheel at a suitable angle for rotating it. Another set of passages are formed in the roof of the water chamber, which allow the water to escape to a second annular space between the compartments, and thence to the outlet-pipe. The outlet passages are oblique and diagonal, and at such an angle that the water in escaping assists to turn the paddle-wheel. The axle of the paddle-wheel which is guided by the thick ebonized partition and a cylindrical boss formed thereon, carries a small gear wheel at its upper end, which communicates motion to a train of wheels serving as counting mechanism, which is connected with dials for indicating the amount of water passing through the water chamber. The wheels of the mechanism are all of ebonite or hard rubber, with properly formed teeth; and their axles have their bearings in a pair of ebonite discs. The parts are so connected with each other that they may be lifted, with the counting mechanism, out of the inner casing for cleansing purposes. The circular glass cover rests on the upper edge of the inner casing; and when screwed down, it serves to press the latter upon a packing-ring placed on the inner flange of the outer box. The axles of all the wheels are made of material not liable to corrosion.

* See JOURNAL, Vol. LIII., p. 68.

Incandescent Gas-Burners.—Upton, C. S., of New York. No. 15,463; Sept. 30, 1890. [8d.]

This invention combines the use of a finely-woven or braided platinum-wire basket, cone, or thimble, with a compound burner for



burning gas and air, or in connection with an ordinary burner designed for the combustion of fuel gas, water gas, or of any other gaseous

substance capable of producing a high degree of heat, by which the platinum cone or thimble is maintained at a high degree of incandescence; also the construction whereby atmospheric air is mingled with the gas, in order to produce more perfect combustion and a higher degree of heat.

Referring to fig. 1, A indicates the burner, which is preferably cylindrical in form; and B, a tube by which gas, or gas and air, is admitted thereto. As a means of mingling air with the gas, the tubes H, connected with the tube B, communicate with the gas passage therein; and these tubes are extended upward and outward, being provided at their upper outer ends with small projections or lugs, and the reflector N, with sockets which fit the projections, so that it is supported in place by the air-tubes H. The reflector is provided at its outer edge with an upwardly projecting rim or flange, which serves to retain in place the shade M, which is supported by the reflector, and which thus serves in the place of a chimney. The reflector is also provided with a central opening directly over the burner; and across this opening is stretched a wire (preferably of platinum), from which is suspended a woven or braided platinum cone, basket, or thimble, concentrically with the burner, and surrounding the upper part thereof. The top of the burner is provided with a circle of small perforations or holes, through which the gas escapes as in the ordinary burner.

The operation is as follows: Gas enters the burner A through the tube B, and air enters the tube, and is mingled with the gas therein through the tubes H, in the desired amount. The mingled gas and air is ignited as it escapes through the small perforations in the top of the burner; and the platinum is at once raised to incandescence, and remains luminous as long as the burner is ignited. By means of the perforated diaphragm D, and the screw E, the amount of gas admitted to the burner is regulated to any desired amount; and a similar regulating device may be applied to the air-tubes H, whereby the amount of air mingled with the gas may also be regulated. The construction shown in fig. 2 is similar to fig. 1, with the exception that the reflector N is omitted, and a ring (provided with a flange O and sockets) is substituted as a support for the shade M, which in this case is shaped somewhat differently from that shown in fig. 1, in order to secure a draught when the reflector with its central opening is not employed. The burner is also provided with perforations for the escape of the gas in its lower side, instead of in its top, as in fig. 1; and the platinum cone or basket is supported from the top of the burner, and extends down around the same.

APPLICATIONS FOR LETTERS PATENT.

18,419.—Falconer, G. B., "Improvements in or relating to apparatus for charging inclined gas-retorts." Nov. 15.

18,457.—Brophy, M. M., "Improvements in the utilization of gas for heating purposes, and in apparatus therefor." Nov. 15.

18,477.—Mannesmann, R., "Method of producing compression strains in guns, gun-barrels, tubes, cylinders, and other hollow bodies subject to high internal pressure." Nov. 15.

18,490.—Orme, D., "Improvements in prepayment gas-meters for automatically supplying a pre-determined quantity of gas in exchange for an inserted coin or coins or tokens or equivalents for value." Nov. 17.

18,618.—Greene, T. A., and Walker, C. M., "Improvements in gas lighting." Nov. 18.

18,644.—Sporton, H. H., and White, E., "Improvements in fluid-meters." Nov. 18.

18,645.—Boult, A. J., "Improvements in gas-engine governors." A communication from W. S. Sharpneck. Nov. 18.

18,672.—Ward, E., "Improved arrangement of or method for jointing the ends of pipes." Nov. 18.

18,681.—Duff, E. J., "Improvements in the manufacture of gas from oils and water vapour." Nov. 19.

18,722.—Twigg, R. H., "Improvements in the construction of liquid-meters." Nov. 19.

18,825.—Staincliffe, J., "Improved means for charging and discharging retorts employed in the manufacture of gas." Nov. 21.

18,871.—Williams, H., "Improvements in the method of and in apparatus for burning gas for heating and steam-generating purposes." Nov. 21.

18,872.—Williams, H., "Improvements in gas-generating apparatus." Nov. 21.

18,974.—Pickup, J. H., Byron, J., and Dransfield, E., "Improvements in gas-lamps." Nov. 22.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

The Gadd and Mason Gasholder.

Sir,—Mr. Cripps, being clearly distrustful of his own power to reply to one single point contained in my two last letters, obtains testimonials from friends and well-wishers. Now, if his presentation of the case to these gentlemen contained only one-quarter of the perversions and misrepresentations of my published words which his "Criticism" and "Rejoinder" rejoice in, I do not wonder at the unflattering conclusions they have drawn regarding the attainments of your humble servant. Indeed, if Mr. Cripps's rendering of my views and demonstrations were correct, I could only look on myself as a sort of mechanical lunatic. It used to be thought that a tree is best known by its fruits. I am credited with having solved a few very difficult practical mechanical problems in my time by my inventions, and have been engaged in theoretical and practical engineering all my working life; yet I am told at this time of day, that, after all, I do not even know the *elements* of mechanics. This is a sort of miracle your readers will find it difficult to swallow, although I might easily take such as implying even a greater tribute to my work than the other thing. Nevertheless, it is far from being a *gentlemanly* mode of attack on the part of the critic; and I for one do not envy the position such a course places him in.

I am truly desirous of ending what seems in danger of degenerating into an unseemly personal squabble; but the remarkable unscrupulousness of Mr. Cripps's latest effusion, which insists, in the face of repeated protests, that I have put forward new mechanical doctrines, compels me to speak out rather more strongly than I otherwise should.

I dealt in my "Review" with the more important of the points of criticism, as the minor and less material can be dealt with when the injustice of the main criticism is acknowledged. In the one point of correctness on the critic's part—viz., pointing out the error of figures, although this was done in such wretched form—I instantly acknowledged the mistake; nevertheless, he harps on this matter in every communication. *Per contra*, when he fell into error regarding the bound cantilevers, and regarding the fact that *two* forces acting *together* (not one only) were treated by me, and also Dr. Todhunter's refutation of his nauseous *plus* and *minus* business, he is silent. Not a word of acknowledgment of possible error. My critic has, as yet, only essayed *one* proof, and that shows my definition of the forces developed to be exactly equivalent to his own; the latter, nevertheless, although equivalent, are not the actual developments. He tries to think this statement proves defeat in some occult manner; but what says the original paper I read at Ryde on the matter? I therein described *two* forces acting on the holder on each side thereof. I said these words, which are as clear as I can conceive possible: "I will ask you to consider with me the tank in which the holder rises and falls, and to realize that here is the base or final circle of resistance to *all* the strains which are generated in the structure." Then, after describing the lines on the diagram, I said: "Thus the rails round the tank are subjected to *two* forces on *each* side; those on the wind side lifting vertically *and* diagonally, while those on the leeward side are acting in the reverse directions." All my subsequent demonstrations were based on the supposition, started with from the first, that the diagonal resistance was in constant operation at *both* sides. The critic, from some cause, has chosen to assume—as it now appears—that my greater detail treatment of the vertical component force was intended to represent it as the sole strain on the rails. Of course, nothing was further from my intention; but this gross misrepresentation was followed by others (regarding my demonstrations) even more gross; and they have been ruthlessly employed, in the face of my earnest protests, in the charitable task of trying to make me appear little better than a drivelling idiot. These peculiar constructions of my language can certainly only be adopted at the expense of depriving all I have written of any sensible meaning. When this course recoils on the critic's own head, he pleads for sympathy. I have faith to think the sympathy of all true men will be with the persecuted inventor.

In answer to his paragraph marked (1), I say that all my experiments were made long ago, and that the present form of them for physical demonstration (to be used on Saturday next, all well) was in existence, had been shown to others, and so notified to you, Sir, *prior* to the appearance of Mr. Cripps's second rejoinder with fig. 10. So that the ignoble suggestion he now makes was fully anticipated, and thus falls very flat indeed. (2) Whether the experiments prove *his* case or not, they fully prove *mine;* and they do not require any special interpretation, proper or otherwise, except such as Nature imposes on any man of common sense. (3) As usual, my critic cannot refrain from direct misquotation. He actually puts words in inverted commas, which I have *never used*. Indeed, I have never said anything whatsoever regarding the *sale* of my holder. Then he adds a mysterious insinuation, and a sort of veiled threat of something in the background. *He* may think this sort of thing honest criticism; but I tell him frankly *I* do not, and I imagine others will hold a similar view; misrepresentation of an opponent's case being the weakest and most childish possible substitute for argument.

Now as to the opinion he expresses of the holder and its inventor. Your columns have fully shown what he says of these at present; but it so happens that the same Mr. Cripps expressed an opinion at an earlier date, before he could come under the baneful influence of the present controversy. Of course, he may, if he likes, desire us to assume that the expression of an opinion in private may be quite different to a public utterance, although I hope not, for very truth's sake. And I can even just imagine that, by a system of dovetailing, bracketing, adding of commas, or other perversions, the two opinions might be shown to not be diametrically opposed. Nevertheless I will fearlessly ask all concerned whether the two are consistent in any truthful sense; and, in the face of this earlier, and probably more spontaneous opinion, what value your readers can place upon the one the critic now gives? The following is Mr. Cripps's own prior expression—not, be it understood, a fanciful paraphrase to put colour on a case; but his own exact words. It was not very long after the invention was first made public that he said: "*About the ingenuity of the invention, there can be no doubt. To my mind, it is one of the happiest thoughts and most ingenious inventions of modern times; its chief merit being that it is not a development from any previous system, but a direct departure from orthodoxy. It delights me to think that the man Mr. Webber scoffed at turns out to be the greatest genius in gasholder construction.*" Was it insincere flattery? if so, what is the *present* position?

W. Gadd.

Manchester, Nov. 26, 1890.

[The above letter ends the correspondence on this subject, as Mr. Cripps, when sending the communication published last week, wrote that, should Mr. Gadd reply to it, we had his authority for saying that further discussion was declined.—Ed. J.G.L.]

Naphthalene Deposits.

Sir,—I have perused with much pleasure Mr. Smythe's paper read before the Southern Association of Gas Engineers, which I consider a very able contribution, and reflects great credit on his management.

With regard, however, to his remarks about the production of naphthalene, I am rather at a loss to understand how the smallness of mains or services can contribute very much to its production; but I can understand mains and services with burs and rough internal surfaces adding in its retention, and so assist in stopping up either a main or service of any capacity, when the naphthalene is already produced. The Redhill Gas Company have considerable lengths of 4 and 3 inch mains running in various outlying country districts, for say three

miles, with limited consumption therefrom, and laid at depths not more than 21 inches from the surface; and the greater portion of our services are only 1 inch and ¾ inch. Yet, for the past sixteen years, we have not had an ounce of naphthalene either on the works or in any of the mains or services—in fact, it is a complete stranger to us, and we have no desire to make its acquaintance.

Redhill, Nov. 29, 1890. C. READ.

Letting High-Power Lamps on Hire.

SIR,—I have read with interest the letter of your correspondent, Mr. F. D. Marshall, contained in your issue of the 18th inst.; and while agreeing with him as to the importance of the subject to which he draws attention, I must ask your leave to correct a slight error into which he has fallen.

He mentions the difficulties he had in the choice of a proper high-power lamp to let out on hire, and then says he adopted "the Schülke (for low-pitched rooms), the Westphal, and the Siemens. I do not mean the Siemens to which you have been used in England, with its dreadful-looking chimney; but the new Siemens, with the inverted flame issuing from small brass tubes."

Now we were used some years ago to the ugly-looking lamp referred to, but the Siemens inverted lamp is the one which we now adopt in this country, in almost all cases; and recently, to meet the case of low-pitched rooms, Mr. Siemens has invented another form of inverted lamp, called the "Cineraria" (on account of the resemblance of its flame to that flower), which is nearly as efficient as the inverted.

Nov. 29, 1890. JOHN HEAD.

The Sale of Coke by Measure.

SIR,—In your issue for Nov. 11, you report (on p. 1008) a case in which The Gaslight and Coke Company were charged before Mr. Shiel, at the Westminster Police Court, for committing a breach of the Metropolis Streets Act, by delivering coke within prohibited hours. Mr. Shiel then decided that, although the Act did not mention coke, and had no interpretation clause, the word "coal" must, as the greater included the less, also include coke. Counsel for the defendants argued that, upon this ruling, it would also include smoke; but I think a more pertinent argument would have been that lime, being subjected to somewhat similar treatment to coke, might as well be termed stone, and dealt with as such. It was stated that an appeal would be made; and doubtless there are many managers like myself who are looking out for the result.

Some of your readers will probably wonder why a country manager should trouble himself about this matter; but my reason is that, in common with many other provincial gas companies, the company I represent has for upwards of 50 years sold coke by the bushel; and should the decision in the above-mentioned case be upheld, we shall, under certain Acts, no longer be able to sell it except by weight. This would be an inconvenience to both ourselves and our customers, without being of any compensating advantage to either.

Nov. 28, 1890. A COUNTRY MANAGER.

Gas-Heated Baths.

SIR,—I desire to call attention again to the above subject, in consequence of the erroneous statements which appeared in your issue for the 11th ult. (p. 1005). The *British Medical Journal* is there stated to have made "numerous experiments;" and among other things (let me presume) is their discovery that "30 cubic feet of gas produces on combustion 60 cubic feet of carbonic acid." I cannot help thinking this is a misprint for "30 cubic feet of gas produces on combustion about 15 cubic feet of carbonic acid." If it is not a misprint, then I can only come to the conclusion that they are totally wrong. I am further convinced that it is an error when I remember that coal gas contains about 46 per cent. of free hydrogen, and 34 per cent. of marsh gas; the free hydrogen giving nothing but pure water on combustion, while the marsh gas produces volume for volume of carbonic acid, which is certainly not one-half of the total volume of the gas burnt.

I write this letter, however, for the purpose of offering a new solution to the vexed and painful question of the cause of deaths due to the heating of baths by gas, and not for the purpose of throwing discredit upon the "numerous experiments" of the *British Medical Journal*. It is this—that the atmosphere of the bath-rooms where the deaths have occurred has been rendered poisonous by the inhalation of carbonic oxide, and not by carbonic acid, through the gas in the heaters having "lit back" to the burner. This point has been overlooked in all the correspondence and paragraphs I have seen on the subject; but I think it is the true solution of the matter. That carbonic oxide is a highly poisonous gas, and more dangerous on inhalation than carbonic acid, is well known to most gas engineers; and I appeal to such able gas chemists as Professor H. B. Dixon, Mr. H. L. Greville, or Mr. J. T. Sheard to communicate to the JOURNAL their views on the point I have raised, and also add an authoritative statement on the relative volumes of carbonic oxide and carbonic acid produced by the combustion of coal gas in bath heaters. I feel convinced that such a communication would be highly interesting to your readers.

Uxbridge, Dec. 1, 1890. S. PENNY.

The Expenditure on the Vyrnwy Water-Works.—The return of the expenditure on the Vyrnwy Water-Works of the Liverpool Corporation for the three months ending Sept. 30 last, shows that the total outlay for that period has been £16,214. Of this, works in connection with the reservoir have cost £3852; the work on the aqueduct, £9128; and land and easements, £262—making a total of £12,972. In addition there has been an outlay of £1543 on the maintenance of the Vyrnwy estate; and of £1588 14s. 6d. on the Vyrnwy Hotel. A boathouse and small reservoir have also been constructed at a cost of £110. The totals of expenditure up to the date of the return are: Embankment and reservoir works, £536,951; quarrying, £201,262; aqueduct, £988,378; land and easements, £281,038—grand total for scheme proper, £2,007,631. Additional expenditure on the Vyrnwy estate has been £25,104; and on the Vyrnwy Hotel, £7842.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The two Houses of Parliament re-assembled last Tuesday for the transaction of business. The earlier date of meeting will not, however, make any difference in the procedure on Private Bills, which will take their usual course. Among the measures of which notice was given on the opening day were the following: A Bill to amend the Procedure in regard to Private Bills relating to Scotland, by the Lord Advocate; a Bill to Regulate and Limit the Powers of the Metropolitan Water Companies in respect of their Charges for the Supply of Water, by Mr. Causton; and a Bill to Provide for the Supply of Water by Meter for Domestic Purposes within the Limits of Supply of the London Water Companies. These Bills (particulars of the last two of which will be found elsewhere) were later in the week presented, and read the first time. Notice has been given of the following Bills: A Bill dealing with the Assessment of Hereditaments containing Machinery, by Mr. H. S. Wright; A Bill for the Registration and Inspection of Steam-Boilers, by Sir W. Houldsworth; and a Bill to Limit Labour to Eight Hours a Day in all Trades and Industries, by Cuninghame Graham.

NOTICES GIVEN FOR PRIVATE BILLS (SESSION 1891) RELATING TO THE SUPPLY OF GAS AND WATER.

Alloa Water.—The Police Commissioners of the burgh of Alloa intend to apply for a Bill to effect the transfer to them of the existing water works and supply, with power to construct additional works, comprising a new reservoir, an enlargement of the existing reservoir, a service reservoir, and various aqueducts and pipe-lines. Further borrowing powers will be sought.

Barmouth Local Board.—The Barmouth Local Board wish to be authorized to construct new works for the supply of Barmouth with water from Llyn Bodlyn, a lake in Merioneth. It is proposed to build an embankment to dam up the water of the lake, and construct a service reservoir, having an area of about 100 square feet. There will be two pipe-lines—one terminating on the main road from Barmouth to Dolgelley; and the other at the eastern corner of the present service reservoir at Ceilwart. Authority to raise and expend money for the foregoing and other purposes specified will be sought, as well as the usual powers granted in connection with water-works undertakings.

Birkenhead Corporation.—A General Bill for which notice has been given by the Birkenhead Corporation will contain a clause providing that, notwithstanding anything contained in section 73 of the Wallasey Local Board Act, 1890, the Board are not to supply gas or water within the gas and water limits of the Corporation.

Bognor Water.—The Bognor Water Company, Limited, desire to be dissolved and re-incorporated, with additional powers and an extended area. A well and pumping-station, with a line of pipes in connection therewith, are the new works projected. Further capital will be required for this and the general purposes of the Company.

Bowman's Oxygen Lighting Company.—Power is to be sought by Bowman's Oxygen Lighting Company, Limited, the registration of which was announced in the JOURNAL last week (p. 1101), to produce, store, and supply oxygen for illuminating and for public and private purposes in the Metropolis; to lay pipes in streets and roads within the Metropolitan area, or some parts thereof; and to levy rates and charges in respect of such supply. It is proposed to enter into agreements with any of the companies supplying gas within the specified area, for the sale of oxygen to them for increasing the illuminating power of their gas. The Company wish, of course, to be permitted to open the streets themselves for the purpose of carrying on their undertaking; but they purpose applying for authority to enable the London Corporation, the Commissioners of Sewers, the London County Council, or any other local body, gas company, or person, to do this on their behalf and at their expense. These bodies are likewise to be empowered to enter into contracts with reference to the manufacture and supply of oxygen. The Act to be applied for will contain the clauses necessary for protecting the works of the Company, recovering the rates and charges levied, and such others as may be requisite.

Brentford Gas.—The Brentford Gas Company notify their intention of applying for an Act to remove doubts as to the interpretation of the provisions of the Gas-Works Clauses Acts, 1847 and 1871, authorizing gas companies to discontinue the supply of gas in the event of a consumer neglecting to pay the amount due from him in respect of gas used, and to amend those provisions so as to admit of the supply being stopped on the consumer's premises without interfering with the public thoroughfare.

Bristol Gas.—The Bristol United Gaslight Company are desirous of changing their name to the Bristol Gas Company, and of making an alteration in their capital by converting it from 10 per cent. into 5 per cent. stock. In the Bill they are about to promote to enable them to do this, they will ask for enlarged borrowing powers, with provision for the sale of stock by auction or tender, and the addition to the paid-up capital of any premiums realized thereon. They will at the same time apply for power to sell or let stoves, meters, fittings, and other appliances, and to supply gas in bulk for resale beyond their limits.

Bude Harbour and Canal.—The Bude Harbour and Canal Company desire authority to maintain their existing water reservoirs at Langford Moor, and other works in connection therewith, and to supply water in bulk or otherwise to any local authority, company, or person, on such terms as may be settled. Additional capital and borrowing powers will be applied for.

Croydon Water.—The Corporation of Croydon wish to be empowered to purchase from the Lambeth Water Company the portion of their mains, pipes, and works now employed in the supply of South Norwood, Upper Norwood, and other parts of the borough; and they notify their intention of applying for an Act to enable them to do this, and to authorize the Company to sell the plant, &c., in

question and transfer to the Corporation their rights in respect thereto. Power to borrow the necessary money will at the same time be asked for.

Darwen Corporation.—The Darwen Corporation are about to ask Parliament to allow them to purchase from the Corporation of Blackburn two of their reservoirs—known respectively by the names of the Pickup Bank and Daisy Green reservoirs—and to construct certain pipe-lines in connection therewith; the whole to form part of the existing water undertaking. Further borrowing powers will be needed.

Dundee Water.—The Dundee Water Commissioners intend to apply for authority to enlarge the Lintrathen reservoir, and to construct new aqueducts, conduits, pipe-lines, and other works. They seek power to impound waters and streams, and to reduce the quantity of compensation water they have now to furnish. It is proposed to extend the present limits of supply, and to apply to the enlarged area all the powers contained in existing Acts. Provisions will be inserted in the Bill with respect to the rating of the undertaking, the sinking fund, the alteration of rates and charges, and the supply of water for domestic purposes beyond the limits. For the various objects enumerated, further money powers will be included in the Bill to be promoted.

Edinburgh Municipal and Police.—The Magistrates and Council of Edinburgh intend to apply for an extension of their police powers; among them being power to provide light for common stairs, passages, private courts, and areas, and to recover the cost from the owners or occupiers, or charge the expense to the burgh assessments or other funds. The Bill will contain a clause enabling the Magistrates to deal with the gas-meter inspection funds.

Falmouth Water.—The Falmouth Water Company desire authority to purchase or lease certain mills and water rights, to amend their Act of 1862 with reference to the upper reservoirs and the sluices in connection therewith, and to make provision as to the supply of compensation water to millowners; also to raise additional capital.

Filey Water and Gas Company.—The Filey Water and Gas Company wish to have their Water Act of 1856 amended, and their limits of supply defined and extended so as to include the whole of the townships of Filey, Lebberston, and Gristhorpe. They will ask to be allowed to sell water in bulk to the Scarborough Corporation, and to have powers conferred upon them in relation to both gas and water supply, the recovery of rates and charges, and the entry upon consumers' premises. Additional capital will be required.

Fylde Water.—The Fylde Water Company seek authority to construct additional works, consisting of three aqueducts connecting their North Barnacre and Grizedale reservoirs with the Calder Dyke. To carry out these, more capital will be needed; and this it is proposed to raise by shares and on loan.

Garw and Ogmore Gas.—Application is intended to be made for an Act to incorporate a company for the construction of works and the manufacture and sale of gas in certain places in Glamorganshire; and the promoters wish to be endowed with all the powers usually conferred upon gas supply undertakers.

Gaslight and Coke Company.—The Gaslight and Coke Company notify their intention of applying for an Act to confer on them such powers as may be requisite to avoid as far as possible the breaking up of streets and roads for the purpose of cutting off the supply of gas to premises supplied by them. Further powers will be asked for, enabling the Company the more readily to recover amounts due to them from consumers of gas; and authorizing them to enter any premises for the purpose of cutting off the supply of gas. The Bill will contain clauses to provide for the recovery by the Company of any expenses they may incur in cutting off the supply, and to impose penalties upon all persons resisting the lawful entry of premises by, and acts of the Company within any premises in relation to cutting off such supply.

Glasgow Boundaries.—The Glasgow Corporation give notice of a Bill for the extension of their boundaries, so as to include (among other places) the police burghs of Hillhead and Maryhill, and for the application of Police and other Acts to the extended city. Powers will be included for the transfer to the Corporation of special drainage and water supply areas; and also provisions for the acquisition of pumping and other works, borrowing money, and charging special rates for water.

Hendon Local Board.—The Hendon Local Board notify their intention of applying for various powers in respect of their district. Among other things they wish to improve the water supply; and with this object to enter into arrangements with the West Middlesex and Colne Valley Water Companies for furnishing a constant and additional supply of water in their district.

Keighley Corporation.—The Keighley Corporation desire an extension of the time fixed by their Acts of 1869 and 1872 for the construction of their water-works. They also wish to carry out new works, and extend existing enactments thereto; purchase land compulsorily, and alter the present provisions as to the compensation reservoir and the quantity of compensation water to be allowed to millowners. The Act to be applied for is a general one, and will include clauses empowering the Corporation to supply gas to local authorities and others beyond the limits of the gas supply as now settled.

Kettering Gas.—The Kettering Gas Company, Limited, desire to be dissolved and re-incorporated with power to supply gas in various places in Northamptonshire, as well as to other places beyond the present limits; to sell gas in bulk; and generally to carry on the business of a gas undertaking. Part of the present capital now limited to a 7 per cent. dividend under the sliding scale is to be converted into a lower amount of 10 per cent. capital; and the new capital to be applied for, it is proposed to issue at 10 per cent. Provisions will be inserted in the Bill for the alteration of the Kettering Gas Order of 1882 in respect to the reserve fund, so that all money applied to that fund (the amount of which is to be left to the discretion of the Company) shall be taken out of the sums available for dividends, for the creation of a pension fund, the erection of workmen's cottages, and other matters.

Leeds Corporation.—The Leeds Corporation, in a General Bill for which they have given notice, ask for authority to extend their gas-works on land situated at Hunslet, and carry on their gas undertaking with all the usual powers, including the creation of a reserve or depreciation fund. They also desire to be empowered to sell portions of their gas undertaking to urban sanitary authorities, and to make provision for ascertaining the price to be paid, and for raising the purchase-money. With regard to the water undertaking, the Corporation will ask to be allowed to continue the existing, and construct additional works, supply water in bulk, levy rates and charges, and create a reserve or depreciation fund. Further money powers will be required.

Leighton Buzzard Gas.—The Leighton Buzzard Gas Company desire to be dissolved and re-incorporated, with power to continue their present works, and manufacture and sell gas in Leighton Buzzard, in the hamlet of Heath and Reach, and in the parish of Linslade; and generally to carry on the business of gas supply. Further capital will be applied for.

Llanelly Water.—The Llanelly Local Board require authority to construct additional works, so as to enable them to afford a better supply of water in their district. The works comprise a storeage and service reservoir, a conduit or pipe-line, a storm-water bye-wash, and the incidental works connected therewith. For the general purposes of the water undertaking, the Board wish to have further borrowing powers.

London Water Commission.—Notice has been given by the Corporation of London of their intention to apply for an Act to authorize the creation of a public authority with power to improve or regulate the supply, and diminish the cost of water in London and adjoining places, and to promote Bills in Parliament for this and other purposes. The constitution of the proposed Commission, the functions with which it is to be endowed, and all other matters relating thereto, will be found fully set out in the text of the principal clauses of the notice, which were given in the JOURNAL last week (p. 1103).

London Water Supply.—This is a notice given by a Committee representing the Vestries and District Boards of London, of their intention to apply for an Act to confer upon the London County Council, or upon a body to be constituted under the title of the "London Water Trust," certain powers in regard to the water supply of the Metropolis. Power will be sought to transfer the undertakings of the eight Water Companies now supplying the Metropolis to the Council or to the representative body to be created on terms to be fixed by a Board of Arbitration; and to empower the new Water Authority to supplement the existing supply by taking water from Rickmansworth and Leatherhead. It is intended to insert clauses relating to the rates of charge. The important parts of the notice were given *in extenso* in the JOURNAL for the 18th ult. (p. 1056).

Lynton Water.—The Lynton Water Company desire to be dissolved and re-incorporated with additional capital powers; also with authority to construct new works, and supply water in Lynton and Countesbury. On the completion of the contemplated works, those now in existence will be kept in reserve. It is proposed to construct a weir across the West Lyn, and build a tank adjoining it. From this the water will be conveyed to other tanks conveniently arranged for the supply of the new district. The usual powers are required for purchasing lands, water rights, &c., compulsorily; for levying rates and charges; and for supplying water in bulk beyond the Company's limits.

Malvern Water.—The Malvern Local Board intend to apply for power to construct water-works and supply water both within and beyond their district. The works are to comprise a storeage reservoir and filter-beds in the parish of Little Malvern, and the necessary pipe-lines for conveying the water from these receptacles into Great Malvern. The usual authority is sought to acquire lands, easements, and water rights by agreement or compulsorily; to break up streets and roads; to supply water by measure, in bulk, and under agreements; and to levy rates and charges. For the purposes above indicated, the Board will ask for power to raise more money.

Manchester Corporation.—In a General Powers Bill for which the Manchester Corporation have given notice, authority is asked for the establishment of a fund for the encouragement of thrift among those officers and servants of the Corporation in regard to whom no such fund now exists, and for the provision of a sum of money to be available for retiring allowances or payments to surviving representatives. The Corporation wish to have their Water-Works Act of 1847 amended, so as to enable them to supply hydraulic power; and also to be authorized to raise more money.

Market Drayton Water.—An Act is to be applied for to authorize the incorporation of a company to supply water in Market Drayton and Little Drayton. The works to be carried out for the purpose comprise a reservoir and various bore-holes at Drayton-in-Hales, and a pipe-line therefrom into the High Street of Market Drayton. The usual powers in regard to the supply of water will be sought; but nothing about capital is mentioned in the notice.

Metropolis Water.—Under this heading, notice is given of an intention to introduce a Bill for amending the Acts relating to the supply of water in the Metropolis and adjacent districts, and requiring the Water Companies, if called upon, to supply water by meter. The general scope of the Bill was indicated in the JOURNAL for the 18th ult. (p. 1056); but fuller details as to its provisions will be found in another column. As intimated elsewhere, the Bill has been introduced by Mr. Gainsford Bruce.

Metropolitan Water Companies' Charges.—Notification has been given of an intended application to Parliament for an Act to amend the law as to the charges of the Metropolitan Water Companies. The Bill is to provide for altering the rates, &c., of the Companies, and the conditions on which they may be levied; and it will contain a provision to the effect that, from and after a time to be named, "an increase in the value or valuation of premises supplied with water shall not enable the water company to make an increased charge, or levy any increased rent in respect thereof."

Mountain Ash Local Board.—Application will be made by the Mountain Ash Local Board for an extension of the time specified by their Act of 1886 for the completion of the water-works therein mentioned, and for power to borrow further money in respect of both these and their gas-works.

Nelson Corporation.—Application is to be made by the Nelson Corporation for an Act in which they seek power (among other things) to extend their gas and water limits so as to include the townships of Roughlee, Booth, Barley-with-Wheatley, and Wheatley Arr, in the parish of Whalley, in Lancashire, and to exercise therein the powers they possess in respect of their present area. The Corporation propose to abandon the construction of two reservoirs authorized by an Act obtained in 1888, and to amend the section respecting compensation water, so that they may be relieved from any liability to furnish it, and instead thereof to compensate those entitled thereto by annual or other money payments. Provision is to be made for altering the constitution of the Gas and Water Committees.

Newark Corporation.—The Newark Corporation are desirous of acquiring the undertaking of the Newark-upon-Trent Water Company; and they will apply for the necessary authority for effecting the transfer of the works and plant, with all the powers and privileges now possessed by the Company.

Northallerton Water.—The Northallerton Local Board are about to apply for power to construct and maintain water-works at Northallerton and Osmotherley for the supply of water in their district as well as in the townships of Brompton and Romanby. The works consist of three reservoirs, with the necessary pipe-lines; and to carry them out the Board will ask for authority to raise money on the district rate. The usual powers as to the taking of lands and streams, and other incidental provisions, will be asked for.

Partick, Hillhead, and Maryhill Gas.—The Partick, Hillhead and Maryhill Gas Company, Limited, desire to be dissolved and reincorporated under the Companies' Acts, 1862 and 1867, with altered capital powers. The new Company wish to retain all their existing privileges as to the supply of gas, and to have authority to purchase additional land. In the Bill to be promoted to carry out these arrangements, provision is to be made for the sale of the Company's undertaking to the Glasgow Corporation or other local authority, and the settlement of the price; also for the purchase by the Company of the works and business of any company or corporation supplying gas within their limits, or of shares or stock therein. In the event of the boundaries of Glasgow being extended so as to include any portion of the Company's district, the Corporation are to be required to purchase the whole or some part of the undertaking, on such terms as may be specified; and the Corporation are to have powers of purchase.

Penmaenmawr Local Board.—Application will be made by the Penmaenmawr Local Board for power to maintain their existing water-works, and make additions thereto for the better supply of their district. The latter comprise a storeage reservoir to be situated on a tributary of the Afon Gyrach, a service reservoir, and the necessary pipe-lines. Further money and other powers will be sought.

Rhyl Gas.—The Rhyl Gas Company, Limited, desire to be dissolved and re-incorporated with all their present privileges, including authority to make and supply water gas. They will ask for additional capital, and the usual powers in regard to meters, fittings, &c.; the manufacture and sale of residual products; the supply of gas in bulk to any public authority or company; and the transfer of the undertaking to such authority.

Southwark and Vauxhall Water.—The Southwark and Vauxhall Water Company intend to apply for power to raise additional capital for the general purposes of their undertaking; and to enter into agreements with local authorities to enable them to enter upon lands under the jurisdiction of such authorities for effecting connections with any mains lying in such lands.

Stourbridge Gas.—The Stourbridge Gas Company seek authority to extend their gas-works, and confirm an agreement entered into between them and the Brierley Hill Gas Company for defining the limits within which these Companies are to lay mains and supply gas. It is proposed to substitute the sliding scale for the present system of charging for gas, and to make provision for the lighting of, and the payment for the public lamps.

Stourbridge Improvement Commissioners.—In a General Bill for which the Stourbridge Improvement Commissioners have given notice, provision is made for the purchase by them of the works of the Stourbridge Gas and Water Companies; and powers necessary for carrying on these undertakings, if acquired, are applied for.

Sunderland and South Shields Water.—The Sunderland and South Shields Water Company intend to apply for an Act to enable them to carry out new works, comprising four pumping stations, with wells and service tanks, and certain conduits and pipe-lines in connection therewith. Two of the stations are to be in the township of Easington-with-Thorpe, another in Seaton-with-Slingley, and the remaining one in Burdon. Powers will be sought for breaking up public and private roads, and laying pipes, purchasing lands, &c. For the various purposes enumerated, additional capital will be required.

Troon Water.—This is the notice of a scheme which the Duke of Portland seeks to carry out for the better supply of Troon with water. The works are to consist of a reservoir on the Aught or Collennan Burn, and pipe-lines thence to the town. The powers to be sought embrace the acquisition of lands in Dundonald; the abstraction and diversion of water; the supply of water in bulk; and authority to sell the works to the County Council of Ayr, or other local authorities, corporations, companies, or persons.

Western Valleys (Monmouthshire) Water.—Application is to be made for powers of incorporation for a Company to construct water-works and supply water in a number of parishes, townships, and places in the county of Monmouthshire. The works consist of filter-beds, aqueducts, and pipe-lines; and the Bill to be applied for will contain all the necessary clauses for protecting them, as well as the streams and waters proposed to be taken. All the powers usually granted to water companies will be asked for.

Whitehaven Town and Harbour.—The Trustees of the Town and Harbour of Whitehaven intend to apply for an Act to enable them to purchase, compulsorily or by agreement, the undertaking of the Whitehaven United Gas Company, Limited, and to carry it on with all the powers possessed by the Company. The district defined in the notice comprises the town and harbour of Whitehaven, and certain townships and places in the parishes of St. Bees and Moresby, in Cumberland. The Trustees are desirous of being empowered to sell gas and water in bulk; also to construct electric lighting works and supply electricity. Authority will be sought to raise more money.

NOTICES OF APPLICATIONS TO THE BOARD OF TRADE FOR PROVISIONAL ORDERS (SESSION 1891).

Under the Gas and Water Works Facilities Act. 1870.

Bramley District Gas and Water.—The Bramley District Gas and Water Company, Limited, seek authority to construct and maintain gas and water works, and to manufacture and supply gas in Bramley, Chilworth, Albury, and other places in Surrey. It is proposed to ask for the repeal of certain provisions of the Guildford Gas Order, 1874, authorizing the Guildford Gas Company to supply gas within the limits to be defined in the Bramley Company's Order, and to enable the two Companies to enter into mutual agreements for the supply of gas by either to any parts of the district.

Cirencester Gas.—The Cirencester Gas Company will apply for power to maintain and continue their existing works, and supply gas in the parishes of Cirencester and Stratton; also to sell gas in bulk, and manufacture residuals, meters, fittings, &c. It is proposed to define the Company's capital, and provide for its increase.

Cirencester Water.—The Cirencester Water Company desire authority to maintain and continue the works they have already constructed, and to supply water within the parishes of Cirencester, Stratton, and Coats. The usual powers as to levying rates and charges will be sought, as well as permission for an increase of capital.

Corsham Water.—The Corsham Water-Works Company, Limited, are about to apply for additional capital, to be raised by the issue of ordinary or preference shares, or both, and by borrowing, for the general purposes of their undertaking.

Godstone District Gas.—Application is to be made by the Godstone District Gas Company, Limited, for power to construct and maintain gas-works and supply gas in Godstone and other places in Surrey. At present the Redhill Gas Company have the right of supply in the places specified; and it is proposed to repeal the provisions of that Company's Act of 1865 in this respect, and empower the two Companies to enter into mutual agreements for the supply of gas by either to any part or parts of the district.

Matlock and District Gas.—The Matlock and District Gas Company, Limited, seek power to maintain and continue their existing gas-works, and supply gas in Matlock and other places in Derbyshire, sell gas in bulk, let meters, fittings, &c., on hire, and raise additional capital.

Matlock Water.—The Matlock Water-Works Company, Limited, wish to increase their capital from £7560 to £20,000, in order to enable them to provide an adequate supply of water for the rapidly increasing population of the district. It is proposed to raise the amount by the creation of £10 shares, or by the issue of debenture stock.

North Sussex Water.—Notification is made of an intended application by certain persons, who will probably be formed into a company, for authority to construct works and supply water to a portion of the parish of Worth, in Sussex, and generally to carry on the business of a water undertaking at Worth

Seaton and Beer Water.—The Hon. Mark George Kerr Rolle is desirous of being authorized to maintain the works now existing, and construct new ones for the supply of water in the parish of Seaton and Beer, in Devonshire, with the usual powers conferred on water undertakers. The works proposed consist of a small service reservoir and a pipe-line.

Southborough Gas.—The Southborough Gaslight and Coke Company intend to apply for authority to maintain, alter, and extend their existing works, and supply gas within certain defined parts of the parishes of Tunbridge, Bridborough, and Speldhurst. They will also ask for power to acquire additional land, raise further capital, and supply meters, fittings, stoves, &c.

South-East Essex Water.—The South-East Essex Gas and Water Company, Limited, propose to apply for authority to construct and maintain water-works, and to supply water in Rayleigh, Rochford, Hockley, and other places in Essex, and levy rates and charges therefor. The well, pumping-station, and reservoir will be situated in the first-named parish; and there are to be three pipe-lines for conveying the water to its destination.

Staines and Egham Gas.—The Staines and Egham District Gas Company, Limited, are desirous of extending their limits of supply so as to include parts of the parishes of Ashford and Stanwell; and they purpose applying for the necessary authority to enable them to do so.

Swaffham Water.—The Swaffham Water Company are about to apply for power to maintain and continue their existing works, and supply water within certain limits to be defined. Further land and additional capital will be required; and authority is to be asked to enable the Company to make agreements with local authorities as to the supply of water in bulk.

Woking Gas.—The Woking District Gas Company, Limited, intend to apply for an Order to enable them to construct and maintain works for the manufacture of gas and residual products, and sell gas in the usual way or in bulk in Woking and other places, or beyond the district specified. The usual powers for supplying meters and fittings, levying rates and charges, &c., will be sought.

Under the Electric Lighting Acts, 1882 and 1888.

Applications for powers in regard to the supply of electricity for lighting and other purposes will be made by the Local Authorities in the undermentioned places; the asterisk (*) indicating that the gas supply is in the hands of the applicants:—

Acton, Bolton,* Bromley, Canterbury, Cardiff, Chiswick, Coventry,* Croydon, Dewsbury,* Ealing, Edinburgh,* Exeter, Gravesend, Hanley, Harrogate, Heckmondwike,* Hertford, Kidderminster, Killarney, Kingston-upon-Thames, Leamington, Llanelly, Londonderry, Newport

(Mon.), Paisley,* Scarborough, Southend, Southport,* South Shields, Stockport,* Sunderland, Surbiton, Torquay, Tunbridge Wells, Tynemouth, Weston-super-Mare, Whitby, and Whitehaven.

Electric Lighting Orders for the following places will be applied for by the companies and firms named :—

Aberystwith—Provincial Electric Light and Power Supply Company, Limited.
Birmingham—Birmingham Electric Supply Company, Limited.
Bishop's Stortford—Bishop's Stortford Electric Light Company, Ltd.
Cork—Irish House-to-House Electric Company, Limited.
Exeter—Exeter Electric Light Company, Limited.
Ipswich—Ipswich Electricity Supply Company, Limited ; Laurence, Scott, and Co., Limited.
Killarney—Mr. C. E. Leahy.
Leamington—Midland Electric Light and Power Company, Limited.
Leeds—National Electric Supply Company, Limited ; Electric Installation and Maintenance Company, Limited ; House-to-House Electricity Company, Limited.
Limerick—Irish House-to-House Electricity Company, Limited.
Liverpool—Liverpool Electric Supply Company, Limited.
London—Camberwell : Camberwell and Islington Electric Light and Power Supply Company, Limited. City : Brush Electrical Engineering Company, Limited. East District : The Laing, Wharton, and Down Construction Syndicate, Limited. Hampstead : Stamford Hill, Tottenham, and Edmonton Electric Light and Power Supply Company, Limited. Islington : Camberwell and Islington Electric Light and Power Supply Company, Limited. North District : Brush Electrical Engineering Company, Limited. Paddington : Paddington and Bayswater Electric Light and Power Supply Company, Limited. Southwark : Brush Electrical Engineering Company, Limited. St. Luke's, Chelsea, and St. George's, Hanover Square : New Cadogan and Belgrave Electric Supply Company, Limited. St. Martin's-in-the-Fields : Messrs. Latimer Clark, Muirhead, and Co., Limited. Westminster (North) : Westminster Electric Supply Corporation.
Maidstone—Electric Installation and Maintenance Company, Limited.
Newcastle-upon-Tyne—Newcastle and District Electric Lighting Company, Limited.
Norwich—Norwich Electricity Company, Limited.
Poole—Brush Electrical Engineering Company, Limited.
Preston—National Electric Supply Company, Limited.
Toxteth Park—Liverpool Electric Supply Company, Limited.
Wandsworth—Stamford Hill, Tottenham, and Edmonton Electric Light and Power Supply Company, Limited.
Weybridge—The Laing, Wharton, and Down Construction Syndicate.
Weymouth—Weymouth Electricity Supply Company, Limited.
Windsor and Eton—Windsor and Eton Electric Light Company, Ltd.
Withington—Manchester House-to-House Electricity Company, Ltd.
Woolwich—Woolwich District Electric Light Company, Limited.

NOTICES OF APPLICATIONS TO THE LOCAL GOVERNMENT BOARD UNDER THE PUBLIC HEALTH ACT, 1875.

Richmond (Yorks.) Gas.—The Corporation of Richmond (Yorks.) are desirous of having the gas-works they now hold as the Municipal Authority, vested in them as the Sanitary Authority, with power to maintain, continue, and extend them, levy rates and charges for the gas supplied, and generally carry on the business of a gas undertaking. It is proposed to make certain incidental financial changes, and to raise further money.

Salford Corporation.—The Salford Corporation wish to use, for the purpose of manufacturing gas and residual products, certain lands purchased by them from the Lancashire and Yorkshire Railway Company, and they will apply for power to do this, and employ their existing funds, and others which they will ask for authority to raise, for the purpose.

Selby Gas.—The Selby Local Board notify their intention to apply for power to maintain and continue their existing, and construct new gas-works, and to manufacture and supply gas within their district. Authority is sought to acquire additional lands, sell gas in bulk, break up streets, extend the mains, enter lands and premises, and supply meters, fittings, and stoves. In order to carry out the works contemplated, the Board require permission to raise £20,500.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.
Thursday, Nov. 20.

(*Before Justices* STEPHEN *and* VAUGHAN WILLIAMS.)

The Queen v. The Justices of Pontypool and the Pontypool Gas and Water Company—The Construction of the Nantymailor Reservoir.

This was an application for a *mandamus* to the Justices of the Peace for the Pontypool Division, directing them to hear and determine an application for a summons against the Pontypool Gas and Water Company for penalties for the non-completion of the Nantymailor reservoir.

It arose under the following circumstances : In 1873 an Act was obtained by the Pontypool Gas and Water Company for the construction of a reservoir within a certain time, with a proviso that if they should not within two years and six months complete, to the satisfaction of the Board of Trade, the existing reservoir (capable of holding 4,500,000 gallons), they should be liable to a penalty of £20 a week after the expiration of the period so limited. In 1880, Mr. John Williams, a publican at Pontypool, issued a summons for penalties ; but the Magistrates held it out of time under the six months' limitation in Jervis's Act, and dismissed it—that is, they considered that the offence was completed when the time fixed had expired, and that the six months ran from then. They granted a case ; but it was not prosecuted. In 1882 Mr. Williams commenced an action for penalties, which was tried in November of that year, and the verdict was in the Company's favour. He appealed ; but his appeal was dismissed in July, 1883. He then went to the House of Lords ; but it was again dismissed in 1885 as being a penal action which a private party could not maintain. Then he applied for another summons before the Magistrates, claiming £15,080 as penalties ; but they refused it, on the ground that they had already adjudicated upon it. The proceedings in the matter have been reported from time to time in the JOURNAL.

Mr. RUEGG appeared for the applicant ; Mr. A. T. LAWRENCE for the Company ; and Mr. RAM for the Magistrates.

The case having been fully argued, their Lordships took time to consider the matter.

Justice VAUGHAN WILLIAMS to-day delivered the judgment of the Court. He said the question for them to determine was whether the previous decision was sufficient ground for the refusal of the Justices to issue the summons applied for. The Court could not review the discretion of the Justices, if they had really and *bond fide* exercised that discretion, even although they might have erred in their judgment on a matter either of fact or of law. This was established by several cases, to which he referred. In the present case, however, it appeared from the affidavit of the Clerk to the Justices that they had not exercised any discretion, but had simply declined jurisdiction ; and therefore the rule for the *mandamus* must be made absolute, directing the Magistrates to hear the evidence, and to decide whether the summons ought or ought not to issue. It was not meant in any way to conclude the question whether the summons ought to issue, but simply that the Justices should exercise their discretion on the matter. There would be no costs.

(*Before Mr. Justice* A. L. SMITH, *and a Common Jury.*)

Hayter v. Cranleigh Water Company.

This was an action to recover the balance of an account for work done on behalf of the Company by the plaintiff. The defendants alleged that the matter had been settled by the payment of £93 16s. 6d. to Mr. S. Simmonds, the plaintiff's Solicitor. The onus of proof being on the defendants,

Mr. R. M. BRAY proceeded to open the case on behalf of the Company. He said a contract was entered into in August, 1886, for certain works, which works were finished—partly by the Company, and partly by the plaintiff—in May, 1887. In July they were measured up, and some correspondence ensued with reference to the adjustment of the accounts. Before any conclusion was arrived at, the plaintiff became bankrupt, and his affairs went into the hands of the Official Receiver. The bankruptcy was afterwards annulled ; and Mr. Simmonds, who was acting for the plaintiff, agreed to accept the £93 16s. 3d. in discharge of all claims. A receipt in full discharge, signed by the plaintiff, was given on payment of this sum. The plaintiff subsequently instructed another solicitor to institute an action for the recovery of the full amount, on the ground that the settlement had been improperly arrived at.

Mr. *F. Smallpiece*, the Solicitor who acted on behalf of the Corporation at the time of the settlement, was then called, and deposed that the plaintiff had executed for the Company certain works which were completed about May, 1887. The Engineer made up the accounts ; and they were sent to Mr. Hayter in July. A correspondence then ensued between witness and Mr. Bolithe (plaintiff's Solicitor). In October, 1887, the plaintiff became bankrupt ; but no settlement was come to with the Official Receiver. On April 26, 1888, witness received a letter purporting to come from Mr. Simmonds, the plaintiff's then Solicitor, stating that the bankruptcy had been closed—the creditors having been paid in full—and that his client claimed a much larger amount than the Company said was due. Witness replied that the accounts had been settled, showing a sum of £93 16s. 3d. to be due ; and this sum had been tendered to the Official Receiver, but had not been accepted. After some further correspondence, Simmonds wrote requesting a cheque for £93 to be sent ; and witness replied that one would be forwarded on the production of an authority from Hayter. Afterwards an authority signed by Hayter, authorizing Simmonds to receive the £93 16s. 6d. in settlement of the account, was received ; and the money was paid by the London agent.

Mr. CALVERT, who appeared for the plaintiff, said he did not dispute the signature ; but it had been obtained by fraud, and Mr. Hayter had never received the amount.

Witness, in further examination, said he had heard nothing more about the matter until July 19, 1889, when he received a letter from Mr. Gedge to the effect that he was adjusting the accounts between Mr. Hayter and his late Solicitor (Mr. Simmonds), and expressing a wish to know the date and amount paid by the Company.

In cross-examination, witness said that he had never seen Mr. Hayter or Mr. Simmonds in the course of the proceedings ; and had no evidence, except the letter, that Mr. Simmonds had been retained to act by Mr. Hayter.

An account was then put in, from which it appeared that the plaintiff had been credited with the £93 in account with Simmonds.

Mr. CALVERT, in addressing the jury on behalf of the plaintiff, said it was a question which of two innocent people were to suffer for the acts of a rogue. The plaintiff did not employ a Solicitor to obtain an amount which the Company were always willing to pay, but to obtain the full amount of the claim. There was no doubt the plaintiff's signature was obtained by the fraud of Simmonds.

Mr. *C. Hayter*, the plaintiff, stated that he employed Simmonds on the 16th of April to carry on the action against the Company ; but he did not authorize him to settle for £93. His claim against the Company amounted to £700 ; and he told Simmonds not to take less than £500 or £600. He was not aware that Simmonds was in treaty with the Company to settle. On the 30th of May Simmonds sent for him, and stated that if the £93 was not accepted the offer would be withdrawn. Witness, being very short of money, signed the receipt ; but afterwards, by telegram, withdrew the authority.

Mr. BRAY objected to the evidence on the ground that a written document would speak for itself.

Justice SMITH said he thought the plaintiff had put himself out of

Court by admitting that he signed the receipt. Withdrawal of the authority afterwards would not do.

In cross-examination, witness admitted receiving the sum of £53 4s. upon settling accounts with Simmonds, but said he was not aware at the time that the £93 was credited to him. He had never denied the statement in Simmonds's affidavit that the account had been settled.

The jury found that plaintiff had authorized Simmonds to settle with the Company.

His Lordship thereupon gave judgment for defendants, with costs.

Tuesday, Nov. 25.

(*Before Justices* STEPHEN *and* VAUGHAN WILLIAMS.)

Merthyr Tydvil Local Board of Health v. Assessment Committee of the Merthyr Tydvil Union.

The Assessment of the Merthyr Tydvil Water-Works.

This case raised a question as to the way in which the rateable value of certain water-works held by the Local Board, under a Special Act, is to be calculated for the purpose of assessment. The whole of the money authorized to be borrowed by the Act has been expended upon permanent works sanctioned therein; part of the money being obtained upon the security of the general district rates of the Board, and part upon the security of the water-rates. In 1880 a valuation of the works took place; the gross estimated value being fixed at £3710, and the net rateable value at £2968. This assessment has continued down to the present time. The Board objected to it, however, on the ground that they were over-assessed in respect of the yearly value of the works and mains occupied by them, and that the water-rates and charges received by them represented the value of the water supplied to their parish, and formed a proper basis for estimating the rateable value of the property. In October, 1889, a new valuation was made at the request of the Assessment Committee, who on receiving it refused to reduce the assessment. The Board appealed to the Quarter Sessions, who stated a case for the opinion of the Court. It appeared from the account kept by the Board in accordance with their Act (which was audited, printed, and circulated) for the year ending March 25, 1889, that the total receipts in respect of water-rates and charges amounted to £5700, and that the total expenditure debited to the water-works was £14,107. In order to balance the accounts, a sum of £8404 was transferred from the general district rate account. No part of the £8404 was a receipt in respect of water-rates, rents, or charges, or of a rate-in-aid; nor was any part of it applied towards the working expenses or the cost of maintaining the works, but partly to the payment of interest on capital borrowed and partly to the payment of instalments on loans. The first item in the valuation prepared by the Assessment Committee—the sum of £8424—was arrived at by subtracting from the £8404 the amount expended in respect of instalment of loan, £5680, and adding the balance of £2724 to the £5700, thereby making the total £8424, the amount alleged by the Committee to be necessary to pay the working expenditure and interest on capital for the current year. The question for the opinion of the Court was which was the correct figure to adopt as the basis of calculation for estimating the rateable value of the works—whether the sum of £5700 only, or that amount supplemented by the £2724. If the Court should be of opinion that the contention of the Board was right, the rateable value was to stand at £2624.

Mr. W. EVANS appeared for the Board; Mr. F. MARSHALL, for the Committee.

At the conclusion of the arguments, their Lordships took time to consider their judgment, which was now given in favour of the Board.

Justice VAUGHAN WILLIAMS delivered the written judgment of the Court, as follows: The answer to questions of this sort, as to the rateable value of land occupied by corporations or companies for purposes of large undertakings for the service of the public, is hardly ever of a satisfactory character, having regard to the object of ascertaining the rateable value, as the question in effect generally is as to the proper conclusions to be drawn from given impossible, hypothetical premisses. If the sum of £2724 is to be treated as part of the money received by the Board for the supply of water, then it would seem properly included in the receipts for the purpose of calculating the rateable value (*Dewsbury v. Penistone*, 16 Q.B.D. Rep., 585); for if the sum is received in payment for water supplied, it is equally a receipt of money available as an item of gross profit in arriving at the profit or debit balance, whether the money is received from the hands of the consumer, by means of a rate-in-aid, or by an unconditional transfer of money from the general district rate. But the money must have been received by the tenant under conditions that make it potentially available to him as an item of gross profit. It is so available if the money is received as the price of water supplied, or as an unconditional aid augmenting the receipts of the tenant; but it is not so received if the tenant received the money on terms that he shall repay it—if, in short, he receives it by way of loan. Now, do the Board receive this money as they would receive money raised by a rate-in-aid as an unconditional aid, or do they receive it by way of loan or otherwise on terms which render it not an item of gross profit? We are of opinion that, having regard to the terms of the Special Act, the money is received by the Board by way of loan, and that it is not the less so received (or, at all events, on terms which prevent it from being an item of gross profit) because repayment is deferred and conditional on a contingency which may never happen—viz., a balance standing to the credit of the water-works account available for repayment of moneys advanced out of the general district rates. We think, therefore, that the contention of the Board is right, and that the £2624 should not be included as a receipt of the tenant for the purpose of arriving at the rateable value.

The appeal was accordingly allowed, with costs.

The Water Supply of Malvern.—A meeting of owners and ratepayers of the Malvern district last Thursday agreed to a scheme for an additional water supply, which is being promoted by the Local Board, under the advice of Mr. Copland. It is proposed to collect the water from the Malvern Hills, as at present, and store it in a natural reservoir, having storeage capacity of 40 million gallons. The scheme was estimated to cost from £35,000 to £40,000.

MISCELLANEOUS NEWS.

BIRMINGHAM CORPORATION GAS SUPPLY.

Prepayment Meters—Bankruptcy and the Collection of Accounts—Railway Rates on Coal—Gas Testing.

In the course of a report which the Gas Committee propose to submit at the meeting of the Birmingham City Council to-day, they state that they have had under consideration the possibility of extending the use of gas in artisans' dwelling-houses throughout the area of supply. They have inquired very fully into the subject, and are of opinion that, having regard to the convenience of the tenants of such houses, and to the competition with other illuminants, it will only be possible to popularize the use of gas in this direction by adopting a system of collecting the payments for the gas at short intervals. It will, however, be essential that the cost of distribution shall not be materially increased by the necessity for frequent visits of collectors; and the Committee have therefore turned their attention to prepayment meters. After an examination of the different methods by which it has been sought to supply limited quantities of gas on the prepayment of a coin, the Committee have arrived at the conclusion that the meter manufactured by Messrs. Sawer and Purves, of Manchester, is most likely to meet the requirements for such a supply in the district. They have, therefore, had the artisans' dwellings in Ryder Street fitted with these meters, and have also arranged with three owners of weekly houses in other parts of the city who have hitherto been supplied with gas for redistribution to their tenants, to fit the houses with these prepayment meters. They have had other applications for these meters from individual consumers now using gas; but they propose to wait the result of the experiments in the houses already referred to before extending the system. The houses in Ryder Street have only been supplied with these meters during the last few weeks; and all the occupants of the houses are now using gas. The principal difficulties which have been experienced so far have arisen from the unfamiliarity of the consumers with the mechanism of the meter. It is not possible yet, the Committee say, with the limited experience of its use, to tell how far a supply of gas can be profitably given in this way at a price that will compare favourably with the cost of other illuminants. The attention of the Committee has been called, in connection with the Bankruptcy Act of 1890—which limits the claim for rent to a period of six months—to the necessity for shortening the period now allowed for the collection of arrears. Under the present system, the supply of gas to a consumer is not disconnected in respect of arrears until after four notices have been sent to him requesting payment, and the lapse of a period of eight months from the beginning of the account. It would not be possible, without interference with the present organization of the office work, to bring the collection of arrears within a period of six months from the beginning of the account; but the Committee have directed that gas accounts shall in the future be closed after three notices have been given to consumers who neglect to pay the account at the time fixed, and within a period of seven months from the beginning of the account. If experience shows that the bad debts of the undertaking are materially increased by losses in bankruptcy under this system, the Committee will take steps to bring the collection within the period of the six months required by the Act. The serious increase on the cost of the carriage of coal by railway to the various works, arising from the withdrawal of rebates on the railway rates granted by the various Railway Companies up to July, 1889, has (it is next remarked) been under the consideration of the Committee. They state that they have been represented on a Committee appointed by the principal gas undertakings in the Midlands and in other parts of England, which was formed on the suggestion of the coalowners interested, for the consideration of the matter. As the additional charge which the railway companies have imposed upon gas coal is a serious one—amounting in the case of Birmingham alone to at least £11,000 a year—the Committee will continue to give their attention to the subject, until some opportunity is afforded of bringing the matter again before the Board of Trade or the Railway Commission. The Committee have, at the request of the Birmingham and District Coal Consumers' Association, promised a contribution of £20 towards the cost of appealing to the Railway Commissioners against the rates charged on the Birmingham Canal Navigation for coal delivered within the city. The Committee report that the testing-room at the Council House has been fitted up; and by permission of the Finance Committee the photometric apparatus provided by them for the use of the Magistrates has been removed to it. Arrangements have also been made by which the gas supplied from the Nechells holder can be officially tested at the Saltley works. The official tests made by the Gas Examiner appointed by the Magistrates have, however, been discontinued since July 31. The daily tests of the illuminating power of the gas have been continued at the works by officials of the department; but the Committee desire that, for the satisfaction of consumers, tests should also be made by an independent person, and they recommend that the General Purposes Committee be requested to consider the best means of securing independent tests of the illuminating power of the gas. The consumption of gas in the half year ended Sept. 30 showed an increase of 4¼ per cent.

LEEDS CORPORATION GAS SUPPLY.

The Corporation Auditors and the Gas Committee's Accounts.

The Finance Committee of the Leeds Corporation have had a conference with the Gas Committee regarding the financial affairs of the latter, some references to which appeared in the JOURNAL last week (p. 1100). It appears that in September, 1885, the Town Council resolved to place the control of the whole of the financial business of the Corporation in the hands of Mr. Derry, the Borough Accountant; but, at the conference, the latter, when questioned as to the outstanding accounts for residuals, answered that the finances of the Gas Department had not yet come under his control. The long and short of the

whole business is (says the *Yorkshire Post*) that several heads of departments, of whom Mr. Lupton is one, do not take kindly to the changing of the old order of things, and are therefore in no hurry to assist in carrying into effect a resolution which centralizes much of the authority and the responsibility they previously possessed in Mr. Derry. The Gas Committee were told that the Finance Committee and the Borough Accountant must either act upon the resolution of September, 1885, or ask the Council whether they desired to rescind it. The Finance Committee, the *Post* remarks, had asked that Mr. Derry might be allowed to collect the outstanding accounts for residuals. "Sooner than permit that," responded Mr. Alderman Gilston (the Chairman of the Gas Committee), "we will bring the whole matter before the Council." The statistics cited in the article quoted from our contemporary last week, as to the tardiness with which the accounts for residuals had been collected, it is said, were admitted to be in the main accurate, with this qualification—that the Auditors had reported upon certain printed statistics, instead of upon their own draft report, when they said that £40,000 and odd was overdue for "residuals." Messrs. Blackburn explain that, but for this mischance, the "etc.," which included £13,000 of money due from the Boar Lane Estate, would not have been included in their estimate. From what both Mr. Derry and Mr. Lupton told the Committee, it was clear that, if the accounts for residuals were to be collected monthly, the department controlled by Mr. Lupton should be strengthened. The outcome of a great deal of talk at the conference, observes the *Post*, was an understanding that Alderman Gilston and the Borough Accountant should inquire into and compare notes on the question as to the extent of the control Mr. Derry has obtained over the financial affairs of other Committees, and how the wishes of the Council with regard to arrears due for residuals could best be carried out.

An "Uneasy Ratepayer" has written to the *Leeds Mercury* pointing out that the income from the sale of residuals in 1882-3 amounted to £67,154; the value of the stock of residuals in hand was £3095; and the amount owing for coke and other residual products was £9636. From the borough annual accounts for the year 1888-9 (15 months), he found the income from residuals amounted to £60,804; the value of the stock of residuals in hand was £1995; and amount owing for coke and other residual products, "&c.," £31,757. From a perusal of these figures, he says, it will be observed that a larger business was done in residuals in the year 1882-3 than in 1888-9, but that the amount owing in 1882-3 was £9636 only, whilst in 1888-9 it was £31,757, and in 1889-90 it was £40,927. The only explanation to be gathered from the borough accounts respecting this large increase in the amount owing for residuals was to be found in the small expression, "&c." If the "&c." for 1889-90 was represented by £17,116 14s. 5d., there was owing for residual products, without any "&c.," £23,810 18s. 4d.

LEICESTER CORPORATION GAS SUPPLY.

Proposed Powers for Additional Capital and for Increasing the Reserve Fund.

At a Special Meeting of the Leicester Town Council last Tuesday—the MAYOR (Mr. Alderman Kempson) presiding—the Gas Committee reported that they had had under consideration the question as to the desirability of seeking to obtain powers to raise additional capital for gas-works purposes. Section 28 of the Leicester Corporation Gas and Water Transfer Act, 1878, authorized £250,000 to be borrowed for the purposes of the gas undertaking. Since the passing of the Act, the Committee stated, the population of the district within the limits of supply had increased very largely; and the consumption of gas had nearly doubled. The above-mentioned sum had all been expended in enlarging the works and extending the mains to meet the increasing requirements, and the borrowing powers were now entirely exhausted. The rapid growth of the population of the borough and area of supply continued, and the consumption of gas was steadily increasing; and the Committee were of opinion that immediate steps should be taken for the purpose of obtaining authority to raise capital to enable the extension of works and mains which the growing requirements would immediately necessitate. Section 36 of the Gas and Water Transfer Act, 1878, the Committee proceeded, provided for the application annually of a portion of the gas revenue in the formation of a reserve fund, to be applied from time to time to answer any deficiency at any time happening in the income of the Corporation from the gas undertaking, or to meet any extraordinary claim or demand at any time arising against the Corporation in respect of the undertaking. The clause limited the maximum amount of this fund at £5000. The Committee were of opinion that this sum was altogether an inadequate reserve fund in proportion to the present and prospective magnitude of the gas undertaking and the possibility of accident thereto. The Committee therefore recommended that the Council should authorize an application to the Local Government Board for a Provisional Order to alter or amend the Leicester Corporation Gas and Water Transfer Act, 1878, so as to enable the Corporation to borrow, for the purpose of the gas undertaking, an additional sum of £100,000, and to authorize the reserve fund to be increased to £50,000.

Mr. LENNARD, in proposing the adoption of the report, observed that from time to time the Gas Committee had submitted to the Council various balance-sheets showing the profit arising from the Gas Department; and it must have been noticed that their authorized capital was dwindling very fast. The Committee now asked the Council to grant them power to apply to the Local Government Board for £100,000 additional capital. Since 1878 when the Corporation took over the gas-works, the amount of coal carbonized showed an increase of 90 per cent.; for whereas it was 49,434 tons in that year, it was 93,721 tons last year. In the same period the mains had increased to the extent of 94 per cent. They could not go on expanding like this without having to take into account the increase of the plant and works. Some four or five years ago, they brought before the Council plans for increasing their works. They were designed to last for a period of ten years, though they had not at that time put in all the material and plant necessary. As justifying the wisdom of the course, he might say that, had it not been for these works being taken in hand and finished so far as they had been at present, about a week or ten days ago they would not have been able to supply the town with gas. They began gas making in the new works on the 22nd ult. The works acquired from the Company were, when completed, capable of producing 5 million cubic feet of gas per day. The new works would produce 4 million cubic feet per day; making a total of 9 millions. They had completed the work so far as to be able to turn another 2 million cubic feet per day out of the four; and this had cost them £100,000. To complete the new works they would have to spend something like £50,000 more. Then there was the annual expenditure for new mains, so that they required a sum of £100,000 to carry the works on to full completion. The Council need not be frightened to grant them the borrowing powers asked for. They would only borrow as they required the money; and as they could borrow at from 3 to 3½ per cent., and make 8 per cent. on the money, the investment should be regarded as a very good one. With regard to the remarks that had been made on another subject by Mr. Wright and Mr. Shires, he should like to remind the outside districts that, if the town saw fit to get rid of the gas-works, and so reduce the borough debt by three-quarters of a million of money, they would have no difficulty in disposing of them—at any rate at no loss. The Committee also asked for powers to increase the reserve fund from £5000 to £50,000. At present they were only allowed, by Act of Parliament, the miserable amount of £5000. If the Council gave the Committee power to accumulate it to £50,000, they would have the increased amount to fall back upon in time of emergency; and he would remind them that the reserve fund could only accumulate in such proportions as the Council determined from time to time.

Mr. COLEMAN, in seconding the proposition, said the only fault he had to find with the recommendation was that it did not go quite far enough. He would like to have obtained a little more money. They would not call it up until it was wanted; but with the present rate of increase of the town, it would not be long before they would have to arrange a further loan.

Alderman HART believed the Committee were pursuing the right course. They should treat their gas business the same as they did any other. The more it developed, and the better profits it produced, the more desirable it was to put capital into it. They might have in the future some competition in the way of the electric light; but the Council might rest assured that it would not in the least interfere with the profits of the gas property, because the electric light could not be produced at anything like a price to compete with it.

The report was adopted.

The TOWN CLERK mentioned that they must send forward the resolution to the Local Government Board before Nov. 30, or they could not apply this session. It was further necessary to send a short statement in support of the application; and he had prepared such a statement.

The Council approved of the statement; and a resolution, empowering the Town Clerk to take the necessary proceedings, was also agreed to.

NEWCASTLE-UNDER-LYME GAS SUPPLY.

Proposed Extension of the Works—The Finances and Profits of the Gas Undertaking.

A Special Meeting of the Newcastle-under-Lyme Town Council was recently held, under the presidency of the Mayor (Mr. E. H. Croydon), for the purpose of ordering the corporate seal to be affixed to the resolution, containing an application to the Local Government Board for a Provisional Order to amend the Newcastle-under-Lyme Corporation Act, 1887, and authorizing the Town Clerk to take the necessary steps for carrying the application into effect. The Chairman of the Gas Committee (Mr. Briggs) moved a resolution setting forth the amendments which it is desired to effect. In the first place, the Corporation wish to be enabled to raise money by way of loans for carrying out the extensions of their gas-works on the lands they now possess. Next they wish to have provision made that section 51 of the above-mentioned Act is to be deemed to have authorized the issue of a series of debentures by the Corporation, and securing the repayment, with interest, of a certain aggregate sum, borrowed with the sanction of the Local Government Board, for the purpose of purchasing the undertaking; such debentures having been issued instead of the debenture stock mentioned in the section. Lastly, the Corporation wish to be enabled from time to time to raise money for the repayment of money borrowed by them, either before or after the date of the resolution, by all or any of the methods prescribed by the Local Loans Act, 1875, notwithstanding anything to the contrary in the Corporation's Act. Mr. Briggs explained that the present powers of the Corporation were deficient, owing to a blunder having been made in the preparation of the existing Act of Parliament; and what they wanted to do was to remedy this, so that they might, as occasion required, be able to raise money for extending their works. He moved that the seal of the Corporation be affixed to the resolution, and that it be forwarded to the Local Government Board. Alderman Heath seconded the motion. In the discussion which followed, it was stated by Mr. Briggs that the Gas Engineer of the Corporation (Mr. W. Winstanley) was engaged in preparing plans of the proposed extensions, and that the Inspector who would be sent down by the Local Government Board would determine how much or how little was necessary. The Corporation ought not to be crippled in the matter. When they took over the undertaking, the Corporation borrowed £74,125, of which £72,875 was outstanding; but the profits had been partly applied to the reduction of the rates. Mr. Ratcliffe contended that £1000 of the profits had been illegally added to the New Municipal Buildings fund. Mr. Briggs took exception to the word "illegally;" pointing out that Manchester had paid for the erection of their Town Hall out of the profits of the gas undertaking. In reply to further questions, he said that when they purchased the gas-works the consumption was 35,529,000 cubic feet per annum; and now it was 65,537,000 cubic feet, or nearly double. This increase in manufacture, he remarked, must mean an increase in plant; and it was to provide for this that they wanted more money. The resolution was passed, as was a second, empowering the Town Clerk to take the necessary steps for obtaining the Provisional Order.

ORIENTAL GAS COMPANY, LIMITED.

An Ordinary General Meeting of this Company was held last Wednesday, at the London Offices, No. 14, St. Mary Axe, E.C.—Mr. H. M'Lauchlan Backler in the chair.

The Secretary (Mr. A. Hersee) read the notice convening the meeting; and it was agreed to take as read the report of the Directors and the statement of accounts for the year ending June 30 last, some particulars from which appeared in the Journal for the 18th ult.

The Chairman said he believed the report which the Directors submitted would be satisfactory to the shareholders generally. There were many favourable features in it; and there were few of a less favourable character. The rental had increased by nearly £2000; and this was due to a variety of causes. First, the public lights had yielded a considerable rental, owing to a large order which was received from the Municipality, and which had been partly executed. Not only was this the case, but they were aware that there were funds provided for a further increase of public lighting, which would come to the Company in due course. Then they had in the course of the year a number of festivals and illuminations on a larger scale than usual, especially during the visit of Prince Albert Victor. These adjuncts to the Company's usual business were profitable, though they entailed some additional expense for specially heating up retorts for the purpose and other work. Still, on the whole, they yielded an advantage which they appreciated. Then there was also an increase in the private consumption of gas; and this, taken together with the public lighting, was most satisfactory. The Board had been looking for this for some time past. True, the increase had only come in a small degree at present; but they had reason to hope that it would be maintained, and trusted it would be continued on a larger scale in the future. With regard to the residuals, coke had not sold so readily; and, in fact, they had been obliged to reduce the price recently, in order to get rid of it. He had explained on previous occasions how it occurred that, in the case of their Company, coke was not disposed of very briskly. The competition against them had been effective; and the only way in which they could meet it was by lowering the price—not quite to the level of the price charged by their competitors, but nearly so. It seemed unreasonable that they should have to do this, because their coke was far superior to the dross coke sold in competition. The natives, however, were not particular as to quality; and would have the article which was offered at the cheaper rate. This was why they were in a difficulty with regard to coke. The expenditure, it would be observed by the accounts, was in fair proportion to the receipts; but there were one or two items which would be found to be rather larger than last year. One especially he might mention—the retort account. The increase in this was owing to considerable renewals of retorts; and it compared with a year during which there were very few renewals. Then, as regarded exchange, the difference in the charge made in the accounts this year was £1533 less than in the previous year. The improvement, however, was in operation during a part of the year only. It would be remembered by the shareholders that some months ago the Silver Bill passed in America gave great hopes that the Company would realize much better in the future than they had been able to do in the past—at least the Directors began to think so, although not over-sanguine generally. But they soon found that their hopes were not to be realized in that respect. As the shareholders knew, very soon after a rise came there was a fall, and the fluctuations had been considerable; and, he (the Chairman) feared, would be so in the future. At present, the average rate of exchange (which was about 1s. 6d.) was not much more than the average of their good and bad years together—not much above the average of the bad years. Now these fluctuations they must look forward to—certainly not hopefully, because they would bring nothing but disappointment if they did so; but they might look for some improvement, and if it was only sufficient to enable them to meet the depreciation in the value of the coke, it would be a very important matter to them. There was another item in the accounts which required explanation. That was the outlay on plant during the year of £3660, which was partly occasioned by an expenditure of £2075 for 7½ miles of mains laid to supply the new public lamps—an expenditure which was productive of good interest to the Company, and which the Directors had no reluctance whatever in incurring. Then there was £1585 to make up the total capital outlay of the year; and this was for part of the cost of the siding into the works. This was also very fruitful expenditure, because it had manifest advantages in it. The total cost of the siding he believed would be about £3000. The advantage would yield not only good interest on the outlay, but would enable them to carry into store, direct from the mines, the coal used for carbonizing purposes. They would not only economize in the actual cost of the coal, but the carbonizing accounts would be materially improved, as coal which was shifted about was not so good for carbonizing purposes as when it was fresh wrought, and not so much exposed to the atmosphere. At present they were assured for some time against any increase in price, because their contracts were made forward; and therefore in this respect they were in a good position. It would be observed on the other side of the accounts that the loans and debentures had been increased by £1900. The Board had an offer of debentures at 4 per cent.; and they had availed themselves of it, in order to meet the outlay to which he had referred. In reviewing the general position of the Company, he thought he might say it had improved to a very satisfactory extent; and it enabled the Board not only to maintain the dividend of 10 per cent. (which had been paid for some years past), but to place £2000 to the reserve account, and to increase the balance of undivided profits by £1737. The Directors liked to have a good amount of undivided profits, because no one could tell what the future might have in store for the Company; and those of them who were connected with other companies knew how they had found a considerable reserve of this nature of great value in times of difficulty. Then they would have cheaper coal, and better carbonizing returns. They had increased rental for public lights; and he hoped they would have a continuation of the additional rental from private lights. Finally, they were free from those labour troubles which had agitated the gas world in England and on the Continent to such a large extent during the year; and they had every reason to believe that such troubles would not occur in Calcutta among the native workmen who were employed by the Company. Taking all these points into consideration, he thought they had really before them a bright and encouraging future. Of course, he could not promise the shareholders that the Company would rise suddenly, or even in the course of time to a great height of prosperity; but he had his own ideas on the subject. He believed the undertaking would materially improve in its working by the means he had pointed out. He should like to add that, if the business did improve, they must bear in mind it was to their interest not to charge the consumers a very high price for gas; and if the Board did not recommend the proprietors to distribute the whole of the excess of profits they might make, it would be because they considered it prudent to give the consumers a portion of the advantage by reducing the price of gas. This they were not in a position to do at present; but as they were in a flourishing condition, he should not like any of the shareholders to go away with the idea that they were likely to have very large profits to divide, and, from what he (the Chairman) knew of the proprietors, they would approve of the course the Directors were pursuing—a course calculated not only to secure the goodwill of the consumers in the present, but to ensure it in the future, and to attach them to the Company as far as possible. He concluded by moving—"That the report and accounts now submitted be received and adopted."

Mr. H. Solomon seconded the motion.

Mr. Sheerman said he observed that £2000 had been transferred to the reserve account. He believed that for some years past they had been in the habit of placing £1000 to reserve; and he asked whether it was necessary—having a reserve of £31,750—to add so much as £2000 to it in one year.

The Chairman replied that the Board had really been in doubt as to whether they should transfer £2000 or £3000 to reserve. A reserve fund of £31,000 was not a large amount for the Company to back themselves up with; seeing that it was not 10 per cent. on the outlay for plant, &c. Judging from the experience acquired in his connection with gas companies during the past 40 years, he considered this was not sufficient; and he should rather advocate an increase of the annual allocation than decrease it.

The motion was carried unanimously.

On the motion of the Chairman, seconded by Mr. C. Hill, Mr. H. L. Hammack and Mr. H. Solomon, the two Directors retiring by rotation, were re-elected.

General Tupper proposed, and Mr. E. F. White seconded, the re-appointment of the Auditors (Mr. J. Blacket Gill and Mr. R. Hesketh Jones).

The proposition having been carried,

A dividend of 6 per cent., free of income-tax (making with the interim dividend of 4 per cent., 10 per cent. for the year), was then declared, on the motion of the Chairman, seconded by Mr. E. Garey.

The Chairman then moved that the best thanks of the meeting be conveyed to the Local Committee, the Secretary (Mr. A. Hersee), the Manager (Mr. D. C. Niven), and the staff generally, for their valuable services during the year.

Mr. Gill seconded the motion; and he took the opportunity of congratulating the Board upon their policy of considering, whenever possible, the consumers, and reducing the price of gas. This, he thought, was sound statesmanship; for, so long as they did their duty to the consumers, the shareholders might be quite certain of receiving handsome dividends.

The proposition was unanimously agreed to.

Mr. R. Hesketh Jones, having congratulated the Chairman upon his improved state of health, and expressed the hope that he would long continue to occupy his present position on the Board, moved a hearty vote of thanks to him and his colleagues.

Mr. Sheerman seconded the motion, which was carried.

The Chairman and the Secretary having replied on behalf of themselves and colleagues, the proceedings terminated.

Winding Up of the Falkingham Gas Company.—The Gas Company at Falkingham, in the Kesteven Division of Lincolnshire, is to be wound up. The dividend on last year's working was 3 per cent.

Sales of Shares.—At the Auction Mart, Tokenhouse Yard, on Tuesday last, Mr. Alfred Richards sold by auction 100 £5 fully-paid shares in the *West Ham Gas Company*, at prices ranging from £11 10s. to £11 15s. per share. On the same occasion, £610 "B" stock in the *Tottenham and Edmonton Gas Company* realized £172 10s. per £100 of stock.—At the Auction Mart, Canterbury, on the following day, Mr. Frank Amos sold £2000 new "A" stock in the *Canterbury Gas and Water Company*. The dividend paid by this Company for the past 15 years has been 8 per cent. The stock was put up in lots of £20; and they fetched from £39 10s. to £40 each. Subsequently Mr. Amos offered £382 of unappropriated consolidated stock in the same Company, in £20 lots; and they realized £39 10s. each. The entire sale produced £4730 12s. 6d.; and the result was regarded as highly satisfactory.

The London County Council and Gas and Water Supply.—At the meeting of the London County Council last Tuesday, Mr. Thornton brought forward the following motion: "That it be an instruction to the Water Supply and Markets Committee to inquire and report as to the practicability, advisability, and probable cost of providing an independent and competing supply of water for the use of the Metropolis." Sir T. Farrer pointed out that this resolution would rather hamper the Committee than assist it, because it was now doing what the honourable member suggested. Mr. Thornton declined to withdraw his motion, and was proceeding to give his reasons for moving it when the debate was adjourned. On the previous Friday, Mr. P. Bunting, one of the members of the Council, when addressing the meeting of the National Liberal Federation, moved a resolution to the effect that the interests of good government urgently demanded that the London County Council should without delay be put in possession of full municipal powers, including the control of the gas and water supplies, and by other financial reforms be enabled to govern and improve the Metropolis without undue pressure upon the occupying ratepayers.

THE COMMERCIAL POSITION OF ELECTRIC LIGHT COMPANIES.

The following is the article, contributed by a correspondent to the *Electrical Review*, dealing with the present commercial position of electric light companies, to which reference was made in our "Electric Lighting Memoranda" last week:—

The present position of the various English electric light companies, from a commercial point of view, is not very satisfactory; and the thought has not unfrequently arisen in the minds of some shareholders as to whether they might not have invested their money to greater advantage. It was, however, not to be expected that during the first two years of working the dividend-paying stage would be reached, although, in two instances, the statements made in the prospectuses were rather too confident of quick returns—a policy which cannot be too strongly deprecated. Nevertheless, the different Metropolitan Companies are now settling down steadily to work; and in the course of another year or two it is possible that the anticipation of the shareholders will be realized—at least to a certain extent. It may, however, perhaps be interesting to review the present commercial position of the Companies, and to consider their future prospects.

Taking the London Companies in the order of their share capital, the following table shows the names, the nominal share capital, the amount paid up, and the approximate number of lamps supplied; the figures being obtained from the latest available official returns:—

Name of Company.	Nominal Capital.	Amount Paid Up.	Approximate Number of Lamps supplied with Current.
London Electric Corporation .	£1,250,000	£654,690	40,000
Metrop. Electric Supply . . .	500,000	201,583	40,000
House-to-House	350,000	36,610	10,000
Westminster Electric Corporat'n	300,000	18,000	6,000
Kensington and Knightsbridge .	250,000	49,780	20,000
Chelsea	100,500	50,000	20,000
Notting Hill	100,000	14,734	..
St. James's and Pall Mall . .	100,000	26,000	21,000

It has not yet been ascertained how much of the gross revenue is absorbed by working expenses, depreciation, &c.; but these items are estimated by two companies to amount to about 50 per cent. of the total receipts. This percentage may possibly be considered to be high; being, in fact, slightly less than the working expenses on an ordinary railway, where they are naturally considerable. The annual income derived from an 8-candle power lamp installed is variously estimated at from 10s. to 14s., or an average of 12s.; and from an 8-candle power to a 16-candle power lamp, £1 per lamp. We will, however, take an average of these two—viz., 16s. per lamp installed. It will, therefore, not be difficult to estimate the average number of lamps which must be in use throughout the year to enable the companies to pay a dividend of 5 per cent. on the total paid-up capital; providing, of course, that the working expenses, &c., do not exceed 50 per cent. of the gross receipts. For instance, the London Electric Supply Corporation would have to supply about 80,000 lamps, although, considering the excessive cost of maintaining such a huge station, this number would doubtless have to be increased by probably 50,000 lamps. The Metropolitan Company, with one-third less of paid-up capital than the London Corporation, would only have to furnish 30,000 lamps; while the House-to-House Company, with its present number of lamps in use, should afford a fair return at the end of the next financial year. The company which is expected to yield probably the best return on the invested capital is, however, the St. James's and Pall Mall Company, which, in a remarkably short period, has obtained customers to the extent of about 21,000 lamps. It might be supposed from the figures given in the table regarding the paid-up capital and the present approximate number of lamps alight, that some of the companies are already in a position to declare a dividend. This assumption is, however, incorrect. The numbers of lamps stated are those which are at present in use; but these must be the average for the year to yield any return. Moreover, since the figures concerning the paid-up capital were compiled, more calls have been made on the shareholders. Thus the approximate number of lights which would have to be supplied as previously stated would have to be increased by (say) 20 per cent. It may, however, be concluded that the commercial position of the Metropolitan Electric Lighting Companies is gradually improving; that in the course of a year or two the dividend-paying stage will be attained; and that the shareholders may rest assured that their investments are assuming a form of stability.

GROUND WATER AND DISEASE.

At the opening meeting of the Royal Meteorological Society for the present session, Mr. BALDWIN LATHAM, the President, delivered an address on "The Relation of Ground Water to Disease."

The President commenced by remarking that whenever ground waters have been found to have fallen very low, outbreaks of epidemic disease have followed. But except under conditions where it is liable to pollution, ground water *per se* probably has no material effect in producing or spreading disease. As a rule, it is only in those places in which there has been a considerable amount of impurity stored in the soil, that diseases become manifest; and probably the most common modes by which diseases are disseminated are supplies of water drawn from the ground or the admission of ground air into human habitations. The President defined ground water as all water found in the surface soil of the earth's crust, except such as may be in combination with the materials forming that crust. It is usually derived from rainfall, by percolation; and it is also produced by condensation. In dry countries it is principally supplied by infiltration from the rivers. The study of underground water shows that certain diseases are more rife when waters are high in the ground, and others when the water is low. The conditions that bring about and accompany low water, however, have by far the most potential influence on health, as all low-water years are, without exception, unhealthy. As a rule, the years of high water are usually healthy, except, as often happens, when high water follows immediately upon marked low water, when on the rise of the water an unhealthy period invariably follows. Mr. Latham has found that those districts which draw their water supplies direct from the ground are usually more subject to epidemics and disease than those in which the water is taken from rivers supplied from more extended areas, or from sources not liable to underground pollution. As an example of this, he cited the case of Croydon, one portion of which is supplied with ground water, and the other with water drawn from the Thames. It is curious to note that, even so recently as 1885, the zymotic death-rate in the district served with ground water was twice as great as in that supplied from the river; and in this particular year 41 deaths from small-pox occurred, not one of which was recorded outside the district which had the ground water. In the course of his address, the President dealt largely with zymotic diseases as affected by ground water; and he showed that cholera ordinarily breaks out when there is the least water of this kind. A high air and ground temperature is also necessary for its development; and as a rule the low-lying districts are favourable to the production of these high temperatures. Small-pox is almost always preceded by a long period of dryness of the ground, as measured by the absence of percolation. Typhoid fever is most prevalent after a dry period, and when the first wetting of the ground or percolation from any cause takes place. Diarrhœa is generally more prevalent in a low-water year than in other years; that is, with a much colder temperature in a low-water year there is a much higher death-rate from this disease. Mr. Latham is of opinion that the general death-rate of a district is amenable to the state of the ground water; years of drought and low water being always the most unhealthy.

METROPOLIS WATER SUPPLY.

Proposed Supply of Water by Meter for Domestic Purposes.

In the JOURNAL for the 18th ult. (p. 1056) we gave the outlines of a Bill, for which the usual parliamentary notice had been given, having for its object the introduction of the meter system in the supply of water for domestic purposes in London. It subsequently transpired that the Bill in question was being brought forward by Mr. Blundell Maple; but, in virtue of arrangements with the other Metropolitan Members for the introduction of measures affecting the Metropolis, it fell to the lot of Mr. Gainsford Bruce to take charge of it in the House of Commons. As will be seen by our "Parliamentary Intelligence" to-day, this gentleman seized the earliest opportunity of bringing it under the attention of the House. The Bill is mentioned in its place in our list of notices of intended applications to Parliament; and, by the courtesy of Mr. Blundell Maple, who has forwarded to us a draft of it, we are able to give its principal provisions.

The object of the Bill, as set forth in the preamble, is to provide for the supply of water by meter for domestic purposes within the limits of supply of the London Water Companies. As the charges at present levied for domestic supplies are based upon the rateable value of the premises served, and as it is considered that these charges are "inequitable and unsatisfactory," it is proposed to ask Parliament to pass a Bill embodying the changes indicated below. The Act is to be cited as the "London Water Act, 1891;" and it is to be in force in the Administrative County of London, as well as in all other places within the limits of supply of the London Water Companies. Unless otherwise provided, it is to come into operation at Lady-day next year. There are only seven clauses in the Bill. By the third, it is provided that the owner or occupier of any premises supplied by water may, after the above-named date, by notice in writing to the Secretary of the Company whose customer he is, require them to "provide a supply to such premises by meter for all purposes other than the purposes of any trade, manufacture, or business," and to accept payment therefore according to a scale given in the second schedule to the Bill, instead of by a water-rate or some similar method. As soon as may be reasonably practicable after the receipt of the notice, the company are to provide and fix a meter on the premises, or arrange with the occupier to provide one. The payment under the new arrangement is to commence from the next usual quarter-day after the fixing of the meter. The company are to be allowed to charge for any meter according to a scale given in the above-mentioned schedule. All the provisions of the Water-Works Clauses Acts, 1847 and 1863, with respect to the payment and recovery of water-rates, are to apply to the payment and recovery of moneys payable in respect of water supplied by meter and also of meter-rents. The Board of Trade are to make regulations as to the provision, fixing, testing, and stamping of meters; and a copy is to be furnished to each Water Company. Meters are not to be liable to distress; and they are to be kept in repair by the Companies, who are to have the power to sell meters after they have been duly stamped. Anyone fraudulently injuring a meter is to be liable to a penalty not exceeding £10, in addition to the amount of the damage sustained, and the Company may discontinue the supply of water to the person so offending until the injury is remedied and the amount of the damages paid.

There are, as already indicated, two schedules to the Bill. The first gives in full the names of the eight Water Companies to whom the provisions of the proposed Act will be applicable. The second relates to the price of water and the scale of meter-rents. The charge for a domestic supply is not to exceed 9d. per 1000 gallons where the quantity furnished in any quarter does not exceed 200,000 gallons, or 6d. per 1000 gallons when it is above this. The meter-rental is to range from 1s. 6d. to 5s. per quarter, according to the diameter of the orifice of the flange or other connection of the meter—starting from ½ inch and rising to 2 inches. Larger sizes by agreement.

Reduction in the Price of Gas Supplied for Motive Power at Batley.—The Gas Committee of the Batley Corporation have reduced from 3s. to 2s. 3d. per 1000 cubic feet the price of gas supplied to gas-engines.

NOTES FROM SCOTLAND.

From our Edinburgh Correspondent.

EDINBURGH, *Saturday.*

There was a good deal of talk at the Edinburgh and Leith Gas Commission last Monday, which is a new departure on their part, and might be supposed to gratify my wishes that they should take the public more into their confidence in conducting their business. But, so far from that being the case, I am worse pleased than ever, because a great deal of what was said was very indiscreet. No good end will be served by the Commissioners giving away their business, which I presume will be the effect, so far as they will have any effect, of the remarks of Mr. Kinloch Anderson. The course of business was something like the following: The reports of the Engineers stated that the quantity of gas manufactured in the Edinburgh works during October was 94,253,000 cubic feet—an increase of 10,322,000 cubic feet over the output in October last year; and the quantity manufactured in the Leith works was 42,277,000 cubic feet, or a decrease of 87,000 cubic feet. The quality of the Edinburgh gas was stated to have been 25·69 candles, as compared with 27·61 candles in October last year; and that of the Leith gas as 26·60 candles, as compared with 29·71 candles last year. Mr. Kinloch Anderson pointed out, with reference to the Leith works, that 147 tons of coal were used more than last year, and that they produced 87,000 cubic feet of gas less. Each ton of coal produced 388 feet of gas less. He only recently learned that the quality of the coal had been reduced. There were general complaints as to the quality of the gas. Bailie Archibald explained that they reduced the quality of the gas by 2 candles; but this was in accordance with advice they received in London, that it was owing to the richness of their gas that ceilings were blackened. Mr. Henderson said they were told the illuminating power of the gas, and he thought they should also be told the pressure. To his mind it was not the quality of the gas that was wrong, it was the want of gas. He was prepared to move that they should have a pressure plan. Mr. R. Mitchell, the Engineer of the Edinburgh works, said if it would be any satisfaction to Mr. Henderson, he would lay a pressure plan of the whole city on the table in one minute. Mr. Henderson said it would do at the next meeting. Mr. Kinloch Anderson said it was not stated that the quality of the gas was to be reduced. The public found this out before the Commissioners. Bailie Archibald said that, if Mr. Kinloch Anderson had been a member of the Works Committee, he would have done the same; he meant that it would have been contrary to the public service to have stated that they intended to reduce the quality of the gas. The Lord Provost suggested that the Committee might report more frequently what they were doing, and this might meet Mr. Anderson's wishes. This is not the first time that Mr. Kinloch Anderson has rushed in where wiser men might fear to tread. His only complaint seemed to be, in the end, that he was not told that the quality of the gas was to be reduced. Now it was, as Bailie Archibald stated, necessary to make no noise about this at the time. It was one of the methods adopted to counterbalance the rise in the price of coal; and if it was not announced formally to the Commission, if Mr. Kinloch Anderson had attended to his dutes he must, long ere now, have discovered, from the Engineers' reports, that the illuminating power had been reduced by 2 candles. Such discussions as Mr. Kinloch Anderson started, do the Commission no good. What they want is that the Conveners of Committees should give a short explanation of what they have done during the month, or what they propose to do; and in that explanation nothing need be stated which the enemies of the gas industry could lay hold of.

Lord Wellwood in the Court of Session to-day gave his judgment in the action which was raised two years ago by Messrs. Mackay and Co., of St. Margaret's Brewery, Edinburgh, with reference to the pollution of a well in their brewery by gas from one of the Edinburgh gasholders. His Lordship holds the Gas Commissioners liable, and has given decree against them for £200. The action was originally brought against the Edinburgh Gas Company; and in January, 1889, it was dismissed by Lord Wellwood on the plea that the Company, for the purposes of suing and being sued, went out of existence on Aug. 1, 1888, when their undertaking was transferred to the Corporations. His decision was appealed to the First Division of the Inner House; but in respect that it would be some time before its turn could arrive for hearing, and in the event of the appeal going against them, any claim which they might make against the Gas Commissioners would be prejudiced, they, in March, 1889, raised an action against the Commissioners similar in every respect to the first. The two cases were ultimately discussed on appeal together; and their Lordships of the Second Division indicated their views upon them, which had the effect of causing the Directors of the still undissolved Edinburgh Gas Company to seek to come to terms with Messrs. Mackay and Co. This they were able to do by payment of a sum of £350 as compensation for the period prior to Aug. 1, 1888. Their Lordships then affirmed Lord Wellwood's decision in the action against the Commissioners, and sent the case back to him for trial. This took place on Nov. 19 last year. Since then the case has been mentioned frequently; and at last it was resolved to proceed with the trial before his Lordship alone, without a jury, Now a decision has been given, which will probably but pave the way for another appeal to the Inner House, and it maybe ultimately to the House of Lords. The decision is an unfortunate one for the Commissioners, not so much because of the amount awarded, but because of the expenses, which it can easily be perceived, must be heavy. There seems to be ground for Lord Wellwood's decision, though I think he has dealt rather severely with the Commissioners in attributing negligence to them in looking after the tank. Otherwise he gave a very subtle analysis of the evidence; and to me it appears that an appeal would have little chance of success.

From our Glasgow Correspondent.

GLASGOW, *Saturday.*

Fully a couple of months ago the Police Commissioners of Lockerbie, in Dumfrieshire, passed a resolution in favour of the adoption of the Burghs Gas Supply (Scotland) Act, 1876; and on Monday of this week, after the reconstitution of the Commission Board by the municipal election near the beginning of November, the resolution was brought forward for confirmation. It was unanimously agreed that the Act be adopted and applied to the Burgh of Lockerbie. If I mistake not, the county town of Dumfries was the first burgh to adopt this Act and put it in force; and the members of the Town Council and the townspeople generally are agreed that, in adopting the Act and acquiring the gas supply undertaking of the town, they did the right thing. It is affirmed by the Dumfries Gas Commissioners that they are now supplying gas to the consumers at a much cheaper rate than would have been the case if the Gas Company had still been dispensing that commodity. If the Lockerbie Gas Commissioners can truly say the same thing a dozen or fifteen years hence, it will be well.

Since the Scotch Gas Act was adopted in the town of Kilsyth, the price of gas to the consumers has beeu reduced 1s. per 1000 cubic feet; and it is thought that the Burgh Commissioners will shortly be able to announce another reduction in price. Their sales of gas have materially increased; and generally their affairs are in such a very satisfactory condition that they have this week felt warranted in making an important addition to the salary of the Gas Manager (Mr. Hamilton). The price of gas just now is 3s. 9d. per 1000 cubic feet; and so recently as 1887 it was 4s. 7d.

There has been some very foggy weather in Glasgow this week, more especially on Thursday and Friday. In the spirit of the old Scotch saying—"It's an ill wind that blaws naebody guid." Though the weather has been unhealthy owing to the thick fog, it has been the means of creating a large demand on the resources of the Corporation Gas Commissioners. Over a number of 24-hour periods, the manufacture of gas had already amounted to 15,000,000 and 16,000,000 and odd cubic feet; but on Thursday it ran up to 17,502,000 feet, as compared with 14,760,000 feet on the corresponding day last year. It was therefore quite a "record" make for a single day; indeed, the biggest day's make in any previous year was that of Dec. 18, 1888, when it ran up to 16,811,000 cubic feet. Last year, again, the largest make in a 24-hour period occurred on Dec. 23; the amount of gas put into the holders being 16,566,000 cubic feet. The make on Thursday of this week was well-nigh reached yesterday, as it amounted to 17,106,000 feet; whereas the corresponding day of last year it was 15,241,000 feet. Then, again, the output from the retorts on Wednesday, the 26th inst., was almost 17,000,000 cubic feet. But all over the month the make of gas has been on an unusually large scale. Its total amount I may be able to give in next week's Glasgow "Notes;" but I may here state that on no day during the month, except Sundays, has it been less than 12,846,000 cubic feet. Such big daily makes of gas as I have just mentioned are spurring on the Special Committee that I alluded to last week, to take definite action with the view of getting one or more suitable sites for additional gasholder accommodation within or immediately adjacent to the city. A make of 18,000,000 feet on one or more December days is confidently looked forward to; and as this is well nigh 50 per cent. more than the actual holder accommodation at the three works belonging to the Glasgow Gas Commissioners, it is quite clear that the Special Committee cannot be a day too soon with their report on the question remitted to them, and their recommendations to meet the prospective demand for gas in the city and suburbs. But the great demand for gas in Glasgow during the month now closing has continued during all the present financial year, beginning the 1st of June. In that month there was an increased make over the corresponding month last year amounting to upwards of 20,500,000 feet; and the increase went on more or less continuously over the whole of the four months ending with October. Over the five months the make increased from 856,459,000 feet in 1889 to 950,191,000 feet in 1890.

This week has been a comparatively quiet one in the Glasgow pig iron warrant market; the business passing from day to day having been mostly of a jobbing character. But as the financial difficulties have been got over and removed out of the way, it is expected that the fluctuations in prices will, for a time at least, be more in accordance with the legitimate demand for iron. It should be borne in mind, however, that there is not at the present time any expansion in the consumption, and that the shipments of Scotch pig iron are decreasing in amount week by week. Forecasts are now being made as to the statement that will be issued at Christmas regarding the extent of the stocks of pig iron held in the public warrant stores and by the ironmasters themselves. It is certain that a larger decrease will be shown than has been known over a very long period. The fluctuations in price this week have been as follows: Scotch warrants, from 49s. 1d. per ton on Monday to 48s. 3½d. cash buyers yesterday; hematite iron, from 55s. 4½d. per ton on Monday to 56s. 4½d., and subsequently back to 55s. 5d. cash buyers; and Cleveland iron, from 44s. 10½d. to 45s. 4d., and back to 45s. per ton cash buyers yesterday. A somewhat uneasy feeling is showing itself among speculators.

There is a marked slackening in the demand for coal throughout most of the colliery districts of Lanarkshire and the West of Scotland; and the coalmasters experience a considerable amount of difficulty in finding an outlet for their output of coal. There has been a further decline of prices this week; indeed, during the past few weeks prices of splint and main coal have fallen from 2s. to 2s. 6d. per ton; so that it is considered very probable that a break in the colliers' wages will soon be made. Since the Lanarkshire blast furnaces were damped down or blown out, some of the ironmasters have found it convenient to enter into contracts with the Coal-Purchasing Committee of the Glasgow Gas Corporation for the sale of their splint coal at prices decidedly lower than those at which gas companies and corporations made their purchases of that kind of coal two or three months since; and in this way the Gas Committee have become less concerned than they were at the unsatisfactory manner in which they were getting delivery of coals purchased at higher prices.

The Bradford Corporation and the Water Supply of Windhill.—The Shipley Local Board have entered into an agreement to supply Windhill with water after the expiration of the lease with Bradford at the end of 1892; but the Bradford Corporation disapprove of being "unceremoniously hoisted in the manner contemplated," and have notified to the Windhill Local Board that, having fairly and properly acquired the right to supply the district, they intend to resist any interference therewith.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 29.

Sulphate of Ammonia.—Prices have again been somewhat easier, notwithstanding that nitrate has remained steady. A fair amount of business is doing; but the bulk of it consists of dealers' purchases, and the latter will apparently only buy at their own prices. There is not much pressure to sell; but makers are naturally anxious about the future, and many prefer to sell even at the low values, rather than hold and take any risks about the disposal of their make. This refers, however, mostly to English makers. Transactions f.o.b. Leith are reported up to March next at prices varying from £10 15s. to £11, which seem very low figures for sulphate deliverable in the consuming season. The transactions during the week comprise Hull sales at £10 12s. 6d. and £10 15s., and Leith at £10 10s. and £10 12s. 6d.

LONDON, *Nov.* 29.

Tar Products.—The week has been a busy one both for buyers and sellers; and a large amount of business has been done—chiefly, however, for forward delivery. Benzol continues firm; and the same remark applies to pitch. Heavy shipments of the latter are taking place; and the demand for fuel making abroad seems to be unusually good. Solvent naphtha is dull. Crude carbolic is also only saleable at an abnormally low price. Important sales of anthracene are reported at 1s. 4d. and 1s. 1d. per unit respectively, less discount. There are no stocks of anthracene; and it is somewhat remarkable that this article does not assume a better value. The following prices have been noted during the week: Tar, 30s. Pitch, 35s. Benzol, 90 per cent., 4s. 7½d.; 50 per cent., 3s.6d. (1d. less in each case for forward delivery). Toluol, 2s. 1d. Solvent naphtha, 1s. 8½d. Crude naphtha, 1s. 8d. Creosote, 2½d. Heavy oils, 3d. Crude carbolic, 60's, 1s. 4d. Cresol, 9d. Anthracene, (30 per cent.), "A" quality, 1s. 4d.; "B" quality, 1s. 1d.

Sulphate of Ammonia.—It is thought that the bottom has been touched in this market; and business is now going on more freely than it has for several months. According to position and conditions of delivery, sales have varied from £10 12s. 6d. to £10 17s. 6d. Ammoniacal liquor is better, at 6s. to 7s. according to position and strength.

The Installation of Inclined Retorts at Rochdale.—The five settings of inclined retorts being erected at Rochdale, under the direction of the Engineer (Mr. T. B. Ball), are now practically speaking complete, and will be put into full operation as soon as the coal-breaking and elevating machinery to be attached to the installation has been finished. Two of the arches are already under fire; and it was expected that one of the settings would be ready for gas making yesterday. The retorts are ⌂ shaped, 15 feet through; and they are arranged seven in a setting, carbonizing about 5 cwt. of coal apiece. The charging is done by means of three travelling swan-neck hoppers, arranged for the three tiers of retorts—this plan being preferred by Mr. Ball to the telescopic charger on the Morris and Van Vestraut system as at Brentford. The contract for the work was entrusted to Messrs. Gibbons Bros., of Dudley; and in the short space of some 15 weeks the whole installation has been efficiently carried out by their Mr. Masters.

The Oil Lighting at Erith.—With the advent of boisterous weather, the complete inefficiency of oil lighting for public thoroughfares again becomes most marked. At Erith it has been found almost impossible to keep the oil-lamps alight; and as the failure of the large lamps at the dangerous cross-roads near the Belvedere Church might result in a serious accident, the West Kent Gas Company, who, through their energetic Secretary (Mr. R. P. Keys), have kindly offered a "helping hand," have, we learn from our local correspondent, been approached by the Erith Local Board for the arrangement of terms whereby the danger will be removed by the substitution of gas as an illuminant in this part of the district. There is no doubt that, with the termination of the contract for the period of oil lighting, the gas will be again adopted throughout the whole of the urban district of Erith; for the present experiment has neither been economical nor cleanly. Any slight saving which might have been apparent on paper in favour of oil as against gas has been quite wiped out by breakages, and further discounted by the want of brilliancy and dark-dispelling power, combined with the nauseating odours and unsightly and damaging drippings from the oil reservoirs. It will, we should think, be a long time before the Erith authorities will venture to experiment in this direction again; for not only have they a discontented public o reckon with, but it is reported that Mr. Defries intends to take action for the recovery of £30 or £40 for wilful damage to his lamps.

The Deimel Gas-Lamp.—Although this excellent regenerative German lamp was protected by an English patent so far back as December, 1887, it has only recently been put into the market. The Deimel Gas-Light Company has been formed, as mentioned in the JOURNAL last week, with offices at 86, Gray's Inn Road; and the business so far has been satisfactory. The lamp is practically an Argand burner with the regenerative principles added. Instead of rising in a circular fashion, as in the Argand burner, the flame is made to play upon a metal bell. The effect is to open the flame, and cause it to assume a bulb-like shape, after the style of ordinary regenerative lamps. A current of air is passed through a piece of metal gauze at the bottom of the burner, and in passing through the opening in the top, it is heated and carried round the flame. A small globe encloses the burner, which enables the heat to be retained near the flame—thus improving combustion. The hot air then passes by the edges of the bulb into the chimney. The lamp gives a very pleasant light in action. There is a peculiar whiteness in the flame, which is exceedingly penetrating; but at the same time it is so soft that it is not disagreeable or injurious to the eyes. A recent test of the lamp showed an illuminating power of 85 candles with a consumption of 10 cubic feet of gas per hour—a very good result. The lamp is greatly improved by the use of an opal shade, which adds to its power. An important matter is that if the glass globe should break (although, we believe, they generally last a long time) an ordinary Argand lamp-glass can be fitted to it, so that there need be no stoppage of the lighting. A point in favour of the Deimel lamp is that it can be attached to existing gas-fittings.

The Kingston-on-Thames Gas Company have issued notices to all the local authorities within their district to the effect that the charge for lighting street lamps from the beginning of the new year will be increased from £3 10s. to £3 13s. 6d. per lamp.

Gas Exhibitions at Southgate and Finchley.—The officials of the Colney Hatch Gas Company have lately been busily engaged in holding exhibitions of gas appliances in various parts of their district. The series commenced in October with an exhibition at New Southgate. This was so successful, that it was followed by one at Southgate, from the 19th to the 22nd ult., and another at North Finchley, from the 25th to the 28th ult. On each occasion a good selection of stoves and other appliances was shown; and lectures on cooking were delivered by Mrs. Helen David. The result of the Company's enterprise has been the fixing of about 30 gas-stoves. Although the letting of stoves on hire has been going on with the Company since 1882, little progress was made, owing to the consumers objecting to the charge made for fixing; and at the end of last year the total number out was only 49. Early in the present year, however, the Manager (Mr. W. F. Broadberry) prevailed upon the Directors to forego the charge; with the result that the number has been increased to 105, and further orders are being received daily.

"Neighbourly Gossip about Gas and Oil."—Under this title, the Sheppy Gas Company are distributing in their district a useful leaflet, in which the advantages of gas as compared with oil, for both heating and illuminating purposes, are set forth in the course of a little neighbourly gossip between Mrs. Bright, a strong advocate of gas, and Mrs. Oldstyle, who knows little or nothing about it, and is content to bear with her evil-smelling oil lamp and stove, although ready to admit the disadvantages and dangers attending their use. Her friend, however, soon enlightens her on the subject of the capabilities of gas; and doubtless ends by giving her ocular proof of the truth of her assertion. There is a great deal of information useful to consumers in Mrs. Bright's remarks; and it is cast in a form which is probably more likely to be read than an elaborately prepared statement. The last page of the leaflet is devoted to instructions as to the reading of a meter index. The whole is a commendable effort of the Directors and the Secretary (Mr. A. W. Marks) to add to their customers.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1134.)

Issue.	Share	When ex-Dividend.	Dividend at Last Meeting.	NAME.	Paid per Share.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Oct.	10½	Alliance & Dublin 10 p. c.	10	16–17	..	6 3 6
100,000	10	,,	7½	Do. 7 p. c.	10	12–13	..	5 15 6
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107–109	..	4 11 9
100,000	20	27 Nov.	8	Bahia, Limited	20	17–19*	..	8 8 5
200,000	5	13 Nov.	7½	Bombay, Limited	5	6¾–7¼	..	5 3 5
40,000	5	,,	7½	Do. New	4	5–5⅝*	..	5 9 1
380,000	Stck.	14 Aug.	12½	Brentford Consolidated	100	213–217	..	5 12 11
125,000	,,	,,	9½	Do. New	100	155–160	..	5 15 7
220,000	20	11 Sept.	11½	Brighton & Hove Original	20	40–42	..	5 9 6
320,000	20	28 Mar.	11½	British	20	43–45	..	5 0 0
50,000	10	11 Sept.	11	Bromley, Ordinary 10 p. c.	10	18–20	..	5 10 0
39,000	10	,,	8	Do. 7 p. c.	10	13–14	..	5 14 3
328,750	10	13 Nov.	6	Buenos Ayres (New) Limited	10	11–12	..	5 0 0
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	103–106	..	5 13 2
150,000	20	14 Aug.	8	Cagliari, Limited	20	25–27	..	5 18 4
550,000	Stck.	10 Oct.	13½	Commercial, Old Stock	100	248–253	..	5 8 8
130,000	,,	,,	10½	Do. New do.	100	198–203	..	5 3 11
130,000	,,	27 June	4½	Do. 4½ p. c. Deb. do.	100	119–124	..	3 12 7
557,320	20	13 June	13	Continental Union, Limited	20	48–50	+1	5 4 0
242,680	20	,,	13	Do. New '69 & '72	14	33⅜–34⅜	–1	5 5 3
200,000	20	,,	10	Do. 7 p. c. Pref.	20	39–41	..	4 17 7
75,000	Stck.	25 Sept.	10	Crystal Palace District	100	190–200	..	5 0 0
234,060	10	16 July	—	European, Limited	10	19–20	..	—
120,000	10	,,	—	Do. New	10	19–20	..	—
354,060	10	,,	—	Do. do.	7½	13⅜–14⅜	..	—
5,470,620	Stck.	14 Aug.	13	Gaslight & Coke, A, Ordinary	100	234–238	..	5 9 2
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	98–101	..	3 19 3
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	247–252	..	3 19 4
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	119–123	..	4 1 3
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	177–182	..	4 2 5
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	164–168	..	4 3 4
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	246–251	..	3 19 8
1,061,150	,,	13 June	4	Do. 4 p. c. Deb. Stk.	100	113–118	..	3 7 10
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	123–128	..	3 10 4
650,000	,,	,,	6	Do. 6 p. c. do.	100	160–164	..	3 13 2
3,800,000	Stck.	13 Nov.	12	Imperial Continental	100	217–221	+3	5 8 7
75,000	5	13 June	6	Malta & Mediterranean, Ltd.	5	5⅛–5⅜	..	5 4 4
500,000	100	1 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	109–111	..	4 10 1
541,920	20	27 Nov.	5½	Monte Video, Limited	20	18–19½*	..	6 13 4
150,000	5	27 Nov	10	Oriental, Limited	5	8¼–9⅛*	..	5 8 1
60,000	5	25 Sept.	7	Ottoman, Limited	5	5–5⅛	..	6 7 3
166,870	10	16 July	4	Para Limited	10	3–4	..	10 0 0
				People's Gas of Chicago—				
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	95–100	..	6 0 0
500,000	100	2 Dec.	6	2nd Do.	100	95–100	..	6 0 0
150,000	10	10 Oct.	10	San Paulo, Limited	10	16–17	..	5 17 8
500,000	Stck.	28 Aug.	13½	South Metropolitan, A Stock	100	285–290	..	4 11 4
1,350,000	,,	,,	11½	Do. B do.	100	228–233	..	4 18 9
141,500	,,	,,	12	Do. C do.	100	235–245	..	4 17 11
650,000	,,	27 June	5	Do. 5 p. c. Deb. Stk.	100	142–147	..	3 8 0
60,000	5	11 Sept.	11½	Tottenham & Edm'nton, Orig.	5	11–13	..	4 8 5
						*Ex Div.		
				WATER COMPANIES.				
728,446	Stck.	13 June	9½	Chelsea, Ordinary	100	271–276	+1	3 8 10
1,720,560	Stck.	10 Oct.	7½	East London, Ordinary	100	211–216	..	3 9 5
544,440	,,	27 June	4½	Do. 4½ p. c. Deb. Stk.	100	142–147	..	3 1 2
700,000	50	13 June	9	Grand Junction	50	120–125	..	3 12 0
708,000	Stck.	14 Aug.	10½	Kent	100	271–276	..	3 16 0
1,013,800	100	27 June	9½	Lambeth, 10 p. c. max.	100	248–253	..	3 15 1
406,200	100	,,	7½	Do. 7½ p. c. max.	100	197–202	..	3 14 3
260,000	Stck.	25 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120–124	..	3 4 6
500,000	100	14 Aug.	12½	New River, New Shares	100	361–366	..	3 6 3
1,000,000	Stck.	31 July	4	Do. 4 p. c. Deb. Stk.	100	125–128	..	3 2 6
902,300	Stck.	13 June	6	S'thwk & V'xhall, 10 p. c. max.	100	167–172	–1	3 9 9
126,500	100	,,	6	Do. 7½ p. c. do.	100	155–160	–3	3 15 1
1,155,666	Stck	13 June	10	West Middlesex	100	262–267	+2	3 14 10

The Glenboig Union Fire-Clay Company, Limited, have bought the Gartcosh Fire-Clay Works, so long carried on by Mr. James Binnie.

New Sulphate Plant at the Portadown Gas-Works.—The Portadown Gas Company are altering their present sulphate plant to the continuous system, and are putting down a new still, superheater, saturator, and condenser. The work has been entrusted to Messrs. R. and J. Dempster, of Manchester.

Stealing Gas at Sheffield.—Yesterday week, Henry Lee, of Aizlewood Road, Sheffield, appeared at the Borough Town Hall on a summons for having stolen, on the 17th ult., a quantity of gas belonging to the Sheffield Gas Company. It was the old story. The gas inlet and outlet pipes were found to have been detached from the meter; and the gas bye-passed by means of an india-rubber tube. The Magistrates considered the case a serious one; but, as the defendant had not been previously convicted, they simply fined him £2, including costs.

Accident to Mr. J. Whyte, of Seaham Harbour.—While superintending some alterations in progress, Mr. James Whyte, the Manager of the Seaham Harbour Gas-Works, met with a serious accident a few days ago. He was standing on a plank, when it suddenly snapped, and he fell a height of about 7½ feet; falling on a plank. He was lifted up and carried into his house, which adjoins the works, and a doctor was sent for. Fortunately no bones were broken, but he was very much bruised. We are glad to learn that he is now progressing favourably towards recovery.

Salford Corporation Gas Committee and the Outlying Districts.—Last Friday afternoon a meeting of representatives of the several local authorities within the area of the Salford gas supply was held at Manchester, to consider a proposal of the Salford Corporation Gas Committee to acquire further lands in Liverpool Street, Salford, for the purpose of extending the gas-works, and to increase the capital by £120,000. The meeting unanimously decided to take every step possible, in view of Salford proceeding with the Bill now before Parliament, to protect the interests of the outlying townships, and to secure the abolition of the differential rate charged to consumers of gas outside the borough, together with a reduction in the actual price of the gas supplied.

Northern Coal Trade.—The northern coal trade has been disturbed by two causes during the last few days—stormy weather retarding steamers, and foggy weather increasing the consumption of gas coal. Best Northumberland steam coal has varied from 11s. 6d. to 11s. 9d. per ton free on board; while small steam, being more plentiful, has fallen to 5s. per ton free on board. Bunker coal, for the use of steamships, has been lower in price, and now varies from 8s. 9d. per ton for unscreened up to 12s. for screened. The demand for gas coals is very large, although the stocks that have accumulated are above the average at this time of the year; but the foggy and cold weather have added considerably to the consumption locally. The production of gas coals is well maintained; and one or two of even the leading colliery-owners have of late accepted as low as 10s. per ton, free on board, for contracts ahead. For the prompt delivery of occasional cargoes, a higher price is asked. Blast-furnace coke is very steady at £1 to £1 10s. per ton free on board, and the demand is well maintained. For gas coke, the manufacturing demand does not much increase. But there is still a considerable shipment going on; and for this it is said that the price free on board is about 13s. 6d. per ton.

The Strike of Gas Workers at Brierley Hill.—Yesterday week, a meeting of the gas-works men on strike was held at Brierley Hill. Mr. Homer presided, and was supported by Mr. W. F. Beston (the men's Secretary) and Mr. Bloor, a member of the Birmingham Town Council. In the course of the Chairman's remarks, he said he regretted to have to meet the men at that meeting; for it might have been avoided if the Directors of the Gas Company had been a little more conciliatory in their dealings with the men. He complimented the men on the quiet manner in which they had conducted the strike, and he encouraged them to continue to be united, and then they would succeed. The Directors were employing "blacklegs," who were costing them more than their own men who had come out, because there had to be more of them, and they were unable to do the same amount of work. So long as the men were behaving while on strike in such an admirable manner, they would be sure to have popular sympathy. One of the men on strike moved—"That this meeting, believing the demands of the men to be reasonable and just, is prepared to support them in their attempts to better their condition, and obtain a reasonable return for their labour." He held that the men had been underpaid; and said he had worked eighteen hours in a day, and had only 4s. for it—not time-and-a-half like other men. The seconder of the resolution averred that the labourers of the Company had only 2s. 8d. per day. After some other speeches, the resolution was carried unanimously. The Birmingham Amalgamated Society of Gas Workers have resolved to support the men on strike, and have agreed to contribute 3d. per week each until the close of the dispute.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams:
"GWYNNEGRAM LONDON."

TELEPHONE No. 2698.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

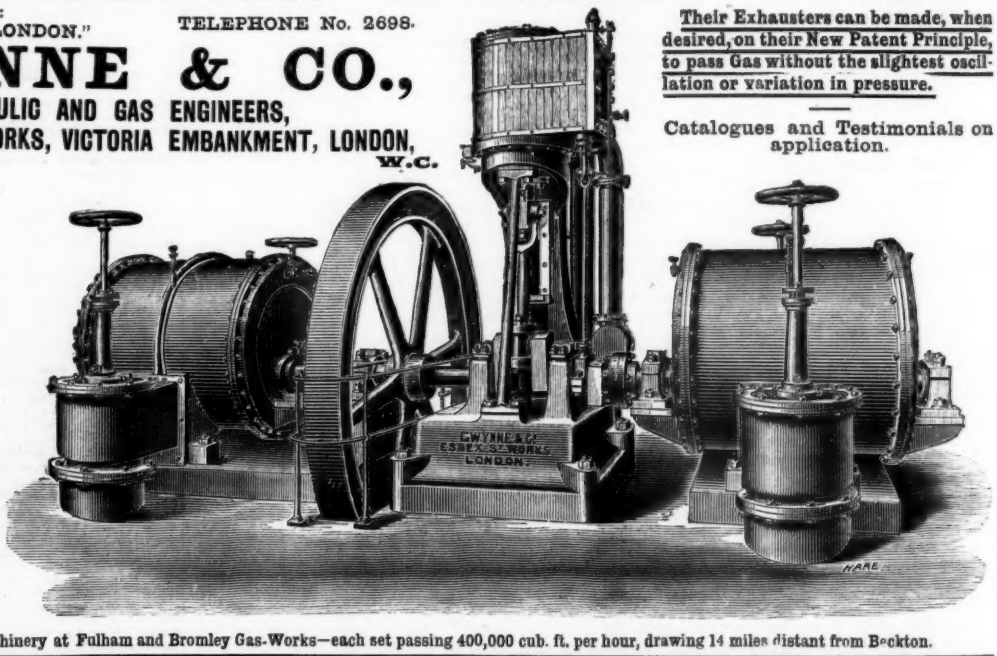
ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co. for Gas Exhausters, &c.

They have completed Exhausters to the extent of 29,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers Gas-Valves, Hydraulic Regulators, Vacuum Governors, Steam-Pumps for Tar, Liquor, or Water; Centrifugal Pumps and Pumping Engines, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.



Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

Catalogues and Testimonials on application.

Exhausting Machinery at Fulham and Bromley Gas-Works—each set passing 400,000 cub. ft. per hour, drawing 14 miles distant from Beckton.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAYS.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
John Wm. O'Neill, Managing Director.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH. Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.

Prices, &c., will be forwarded on application to No. 80, St. Andrew Square, Edinburgh, / Newton Grange, near Dalkeith, } Scotland.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.

Postal Address: 1, Whittington Avenue, E.C.
Telegram Address: "Eirwal London."

W. C. HOLMES & Co., Huddersfield, and 80, Cannon Street, London, Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.

*** See Advertisement p. 1170 of this week's issue.

Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. Spent Oxide and Sulphate of Ammonia purchased. 120 and 121, Newgate Street, London, E.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

SULPHURIC ACID.

HUGH WALLACE & CO., Chemical Manufacturers (the old-established firm), supply the above, which is specially adapted for making White Sulphate of Ammonia. The latter purchased in any quantity at highest market prices, or contracts for the year.

For price and terms apply Botolph House, Eastcheap, LONDON, E.C.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 85, Gracechurch Street, LONDON; 70, Wellington Street, GLASGOW; 10, Marsden Street, MANCHESTER; and 96, Reade Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.

Head Office: MIDDLESBROUGH. Correspondence invited.

EXTRACT from the Harrogate Gas Company's Report, dated the 5th of February, 1890: Coal consumed, 8600 tons. Gas made, 92,880,000 feet; ditto sold, 84,880,000 feet; ditto unaccounted for, 8,000,000 feet; quantity made per ton, 10,800 feet; ditto sold, 9869 feet. Illuminating Power, 16·1 candles. Coals used, Brancepeth. Owners, Strakers and Love, Newcastle-on-Tyne; who have also Brandon Hutton Seam Unscreened Gas Coal. Analysis, 10,500 cubic feet per ton; Illuminating Power, 16·3 candles.

WANTED, by a competent Man, a situation as FOREMAN or INSPECTOR. No objection to going abroad. Several years in last situation.

Address No. 1882, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SCOTCH GAS COALS.

A Gentleman connected with Gas Companies in South Wales would treat with view to AGENCY OF SCOTCH GAS COALS.

Address No. 1876, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

NUNEATON GAS COMPANY.

CLERK.

WANTED a Clerk, to assist in inspecting Meters, Collecting, and Book-keeping. Bond to be given for £100.

Apply, enclosing testimonials, and stating age and salary required, to the SECRETARY, Gas-Works, NUNEATON.

WANTED, a Tar Distiller accustomed to the Extraction and Distillation of Benzol, and Manufacture of Sulphate of Ammonia.

Apply to NEWTON, CHAMBERS, AND CO., LIMITED, Thorncliffe Iron-Works, near SHEFFIELD.

OUTDOOR INSPECTOR.

WANTED, by a Gas Company in the South of England, making about 150 millions per annum, an OUTDOOR INSPECTOR, competent to take charge of the Distribution Department, and control of the working Staff, under supervision. He must be an energetic, persevering young man, of good address, well up in the modern appliances for Lighting, Cooking, and Heating, and able to advise Consumers on all matters connected with the use of Gas.

Testimonials will not be required in the first instance; but the strictest inquiry will be made as to the character of any selected applicant.

Apply, stating age, qualifications, salary required, and past or present employment, to No. 1883, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED copies of the "Journal of GAS LIGHTING" for the 2nd of December, 1879.

Address No. 1884, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Address: "Braddock, Oldham."

COZE'S Automatic Apparatus for CHARGING AND DISCHARGING GAS-RETORTS. For Illustrated Advertisement of this System, see p. 1198.

Inquiries should be addressed to THE AUTOMATIC COAL-GAS COMPANY, LIMITED, 86-88a, LEADENHALL STREET, E.C.

TAR and Liquor wanted.

BROTHERTON AND CO., Commercial Buildings, LEEDS.

WANTED, a Representative who can SELL GAS COAL, and has a connection in the Eastern Counties.

Apply, by letter, giving full particulars, to No. 1878, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.

Address, stating price per ton and quantity, No. 1766, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ON SALE—One or two good Station GAS-METERS, 4-inch Inlets.

Apply to the SECRETARY, Bramham Consumers' Gas Company, Limited, Bramham, Boston Spa, YORKS.

FOR SALE—Truro Gas Company's Shares:

17 at £25 0s. 0d.
19 at £7 10s. 0d.
17 at £5 0s. 0d.

The Dividend paid on the above for the year ending June 30, 1890, was at the rate of 7 per cent per annum.

Also three DEBENTURE BONDS of £50 each in the same Company; bearing Interest at the rate of 4 per cent. per annum.

Offers for purchase of above to be addressed to Mr. J. HAMILTON, 21, Bedford Street, Strand, LONDON, W.C.

FOR SALE—Seven Purifiers, 15 feet square, with Sieves, Connections, Valves, and Lifting Apparatus complete.

One PURIFIER, 20 ft. by 16 ft., with Sieves, Connections, Valves, and Lifting Apparatus complete.

Two Wrought-Iron TANKS, 8 feet diameter by 7 feet and 6 feet respectively.

One REID'S GAS WASHER.

Two Cast-Iron TANKS, 15 ft. 8 in. diameter by 11 ft. 4 in. and 8 ft. 6 in. respectively.

Two EXHAUSTERS (Jones), equal to 25,000 cubic feet per hour.

A number of 15-inch and other VALVES.

A quantity of SHAFTING and PULLEYS.

J. HEPWORTH.

Gas-Works, Carlisle, Nov. 14, 1890.

THE GASLIGHT AND COKE COMPANY.

NOTICE is hereby given, that the TRANSFER BOOKS of this Company so far as they relate to the Debenture Stocks and Bonds WILL BE CLOSED on the evening of Wednesday, the 10th of December inst., for the Half-Year ending on the 31st of December, 1890, and that the Interest for that Half-Year will be payable on the 1st of January next to the Proprietors registered as the holders of such Debenture, Stocks and Bonds at the time of such closing of the Transfer Books, which will be re-opened for the following Half-Year on the morning of Thursday, the 11th of December inst.

By order,
JOHN ORWELL PHILLIPS,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., Dec. 1, 1890.

BENTLEY & CO.

MANCHESTER ELECTRICAL STORES.

FOR Batteries, Bells, Wires, and Special Electrical Apparatus, address the best house 17, NEWTON STREET, PICCADILLY, MANCHESTER.

TO BE LET, on Lease, a small GAS-WORKS, with a good Coal Business.

For particulars apply to GEO. WRIGHT, Hogsthorpe, Alford, LINCS.

THE Gas Committee of the Leeds Corporation, invite TENDERS for the purchase of about 70 tons of SPENT OXIDE.

Samples may be obtained on application to Mr. Lupton, Gas Department, Municipal Offices, Leeds; and price per unit of Sulphur per ton to be quoted, addressed to the Chairman of the Gas Committee, at the above address, not later than Wednesday, the 17th of December next.

RETORTS AND FIRE-BRICKS.

THE Directors of the Rochester, Chatham, and Strood Gaslight Company are prepared to receive TENDERS for the supply of 1200 feet run of CLAY RETORTS, 54,000 FIRE-BRICKS, 60 TILES, and 50 tons of CLAY, according to specification and form of tender, which may be had on application at their Office, 58, High Street, Rochester, where tenders must be delivered before Noon on Thursday, the 18th of December, 1890.

By order,
WILLIAM SYMS,
Nov. 22, 1890. Secretary and Engineer.

SOUTHWARK & VAUXHALL WATER COMPANY

TO COAL MERCHANTS.

THE Directors invite Tenders for the supply, at their several Stations, of about 20,000 tons (more or less) of COAL, during the year 1891.

Specification and form of tender may be obtained at the Office of the Engineer upon payment of 10s. 6d.; and the same must be sent in not later than the 8th of December, 1890, addressed to the Chairman, Southwark and Vauxhall Water Company, Southwark Bridge Road S.E., and endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender.

Southwark Bridge Road,
Nov. 26, 1890.

SOUTHWARK & VAUXHALL WATER COMPANY.

TO PIPE FOUNDERS.

THE Directors are prepared to receive TENDERS from Manufacturers willing to supply CAST-IRON WATER-MAINS and SPECIAL CASTINGS required by their Company.

Specification and form of tender may be obtained at the Office of the Engineer upon payment of 10s. 6d., and the same must be sent in not later than the 8th of December, 1890, addressed to the Chairman, Southwark and Vauxhall Water Company, and endorsed "Tender for Pipes."

The Directors do not bind themselves to accept the lowest or any tender.

Southwark and Vauxhall Water Company,
Southwark Bridge Road, S.E.,
Nov. 27, 1890.

FOR Distribution among Gas Consumers or at Exhibitions.—A 4pp. Leaflet entitled "THE USE OF GAS-STOVES IN OUR HOMES;" being a reprint of an article from the *Home Provider*. Price 3s. 6d. per 100. Special quotations for larger quantities, and, if required, for printing Gas Company's own announcement on first or last page. Specimen copy, free by post, 1½d.

May be obtained of S. H. E. FOXWELL, Office of the *Home Circle and Provider*, 48, Temple Chambers TEMPLE AVENUE, E.C.; and of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

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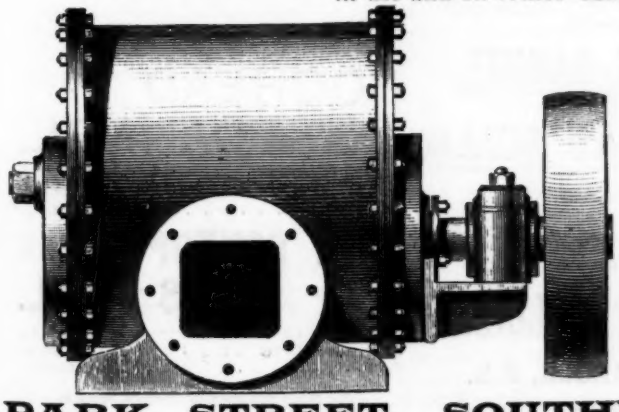

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Coke per Ton, - - - - - - - 57 per cent. of a quality almost equal to that made from the best Coking Coal.

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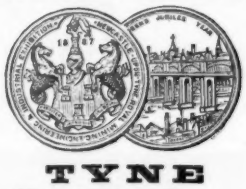

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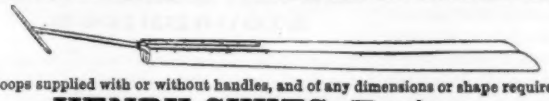

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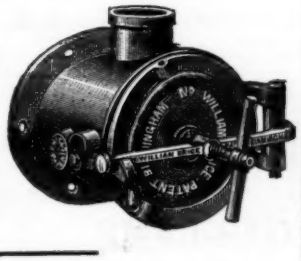

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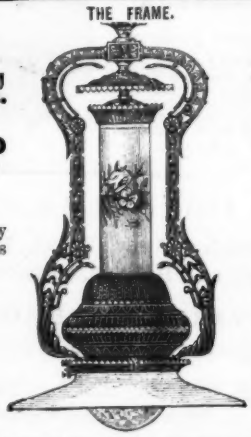

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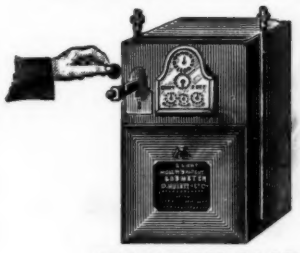

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Size of Fire: 11 in. by 9 in.

Price: £3 15s.

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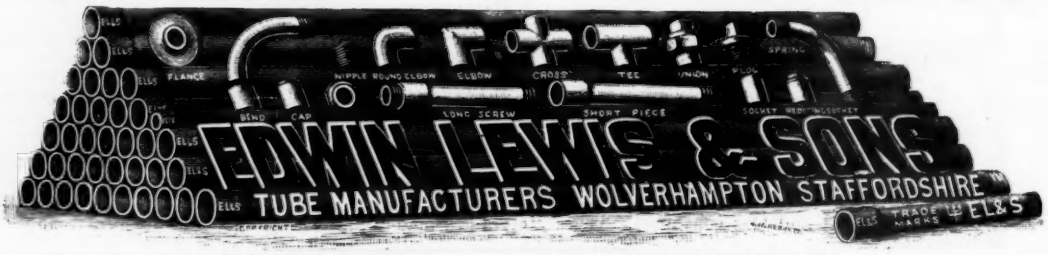

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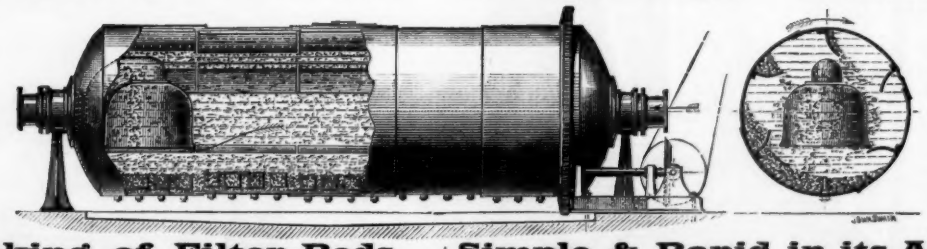

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And Fittings and Accessories.

LAMBERT BROS., WALSALL,

MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM,
BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c.; AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: T. LAMBERT & SONS, Short Street, LAMBETH.

GAS COAL.

BEST
REAL OLD SILKSTONE GAS COAL.
Address, THE STRAFFORD COLLIERIES COMPANY,
Near BARNSLEY, SOUTH YORKSHIRE.

ALDER AND MACKAY,

MANUFACTURERS OF

IMPROVED WET AND DRY GAS-METERS

IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.

ORIGINAL MANUFACTURERS OF DRY METERS IN CAST-IRON CASES.

STATION METERS, EXPERIMENTAL METERS, PHOTOMETERS, & PRESSURE-GAUGES, &c.

Results of Tests of Dry Gas-Meters (Section III.) of the Glasgow Philosophical Society's Gas Exhibition, as per London "Gas Journal," May 10, 1881.

	ALDER & MACKAY.	W. & B. Cowan.	G. Glover & Co.	James Keith.	D. B. Peebles & Co.
Total of Fast Tests . .	47·2 ...	6·9 ...	33·6 ...	62·3 ...	53·7
Total of Slow Tests . .	25·3 ...	117·4 ...	43·1 ...	31·4 ...	38·5
	72·5 ...	124·3 ...	76·7 ...	93·7 ...	92·2

SOLE AGENTS FOR THE "SENTINEL" GAS GOVERNOR IN SCOTLAND AND IRELAND.

Descriptive Circulars, Price Lists, and Full Particulars forwarded on application.
GRANGE WORKS, EDINBURGH.

NEW REGENERATIVE GAS-FIRE

(FOULIS' PATENT)

Made in two sizes 24 and 28 inches wide over base.

MADE ALSO AS COMBINED REGISTER STOVE. (See last Week's JOURNAL.)

Designed and perfected by the Patentee,
WILLIAM FOULIS, Esq., C.E.,
Glasgow Corporation Gas-Works.

Proved to be the most efficient Stove in use.
Heat easily Maintained.

Made by CARRON CO.

Wholesale Agents:
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JAMES MILNE & SON
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111, St. Vincent Street, Glasgow.

PARTICULARS ON APPLICATION.

THE SILICA FIRE-BRICK COMPANY,

OUGHTYBRIDGE, NEAR SHEFFIELD.

Established 1858. The First Manufactory of Silica and Dinas Fire-Bricks erected in England.

MANUFACTURERS OF

SILICA FIRE-BRICKS,

(TRADE MARK "SILICA")

Specially adapted for Siemens-Martin Gas-Furnaces; also for Gas, Copper, Iron, Steel, and other Furnaces where intense heat is required.

BESSEMER GANNISTER, STEEL-FURNACE GANNISTER, COPPER-FURNACE GANNISTER, IRONFOUNDERS' CUPOLA SAND, FINE-SETTING SILICA CEMENT, STEEL MOULDERS' COMPOSITION.

Our Silica Bricks have gained a high reputation for Unsurpassed Quality in most of the leading Firms in England and on the Continent. Export orders delivered Liverpool, Hull, Grimsby, or the Tyne.

THE ALBO-CARBON LIGHT.

ESTABLISHED TWELVE YEARS. Hundreds of thousands in use.

UNEQUALLED FOR BRIGHTNESS, SOFTNESS, & ECONOMY.

SINGLE LIGHTS FROM 6S UPWARDS. CLUSTERS FROM 40S. TO 145S.

SAVE half your Gas Bill. The Greatest Success of the Day.

Albo-Carbon, genuine fluted, 18s. cwt., 3d. lb.

AGENCIES GRANTED. LIBERAL TERMS.

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FOR PRICES, ETC., ADDRESS

ALBO-CARBON LIGHT COMPANY, LIMITED, 74c., JAMES STREET, WESTMINSTER, S.W.

WEST'S GAS IMPROVEMENT Co., Ltd.,

Engineers, Ironfounders, & Contractors,

ALBION IRON-WORKS, MILES PLATTING, MANCHESTER,

MANUFACTURERS OF

WEST'S PATENTED MACHINERY

FOR

CHARGING AND DRAWING GAS-RETORTS.

OVER **180** MACHINES AT WORK AND IN COURSE OF CONSTRUCTION.

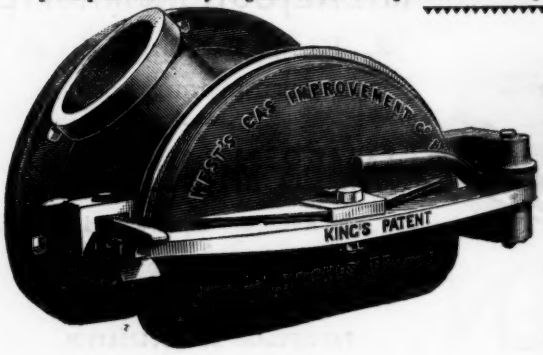
Advantages attending its use are:

INCREASED VOLUME of GAS per TON, and INCREASED YIELD per Retort.—The system of breaking and distributing the coals in an even layer in the retorts effecting more perfect carbonization.

REDUCTION in LABOUR and COST of WORKING.—In Works where this System of charging and drawing Retorts is adopted, there has been effected a substantial saving in the cost of Gas Manufacture in the Retort-House; the amount saved varying in different Gas-Works from **8 PENCE** to **15 PENCE per Ton** of coal carbonized. Full particulars will be forwarded upon application to W. G. I. Company, Limited.

MANUAL CHARGING AND DRAWING MACHINES.

POWER CHARGING AND DRAWING MACHINES, driven by COMPRESSED AIR, STEAM, or ROPE. The power machines are applicable to circular, oval, or ⌂-shaped retorts and mouthpieces, and are the most perfect, economical, efficient, and durable machines made. They are constructed on principles founded by long and extensive experience in this special branch of gas engineering and the manufacture of gas.



MAKERS OF COAL BREAKING, ELEVATING, AND CONVEYING MACHINERY, COKE BREAKING AND WASHING MACHINERY.

Sole Makers of **CIRCULAR, OVAL, or ⌂-shaped MOUTHPIECES** with Morton's Self-Sealing Lids, fitted with

KING'S PATENT FASTENINGS,

which, by a simple wedging action at each end of the crossbar, secure a very tight joint; and at the same time, by their long sliding motion, they effectually remove the tar or other matter from the surfaces of the mouthpiece and lid.

N.B.—The whole of these Fittings are made of Wrought Iron.

West's Improved Combined Regulating Liquor Seal Valve.

OXIDE ELEVATING MACHINERY, COKE BARROWS, VALVES, AND ALL GAS-WORKS PLANT, &c.

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BRECKENRIDGE CANNEL

AND THE

OLD KENTUCKY BOGHEAD

OF KENTUCKY, U.S.A.

These Cannels will rank with the Australian Shale for Gas Manufacture.

Also General Sales Agents for

PENNSYLVANIA & VIRGINIA GAS COALS, & AMERICAN FOUNDRY & FURNACE COKE.

Delivery Prices made to any Port in

GREAT BRITAIN, ON THE CONTINENT, OR SOUTH AMERICA.

Full Information furnished upon Application to the above Address.

CHEAP STEAM — FOR — GAS-WORKS.

MASON'S PATENT FURNACE

Can be applied to any kind of Boiler.

It improves the draught.

Economises time in raising steam.

Gives steam quickly at any pressure.

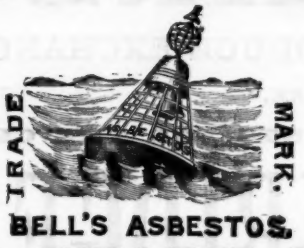
THE ONLY FUEL recommended is

COKE DUST,
COAL DUST,
CINDERS,
SAWDUST,
BREEZE,

Or any other Refuse Fuel.

W. F. MASON, *ENGINEER and PATENTEE,* Longsight, MANCHESTER.

BELL'S ASBESTOS

AQUOL  PAINT

IS MADE READY FOR USE.

IS FIRE RESISTING.
IS WASHABLE.
IS NON-POISONOUS.
IS MANUFACTURED IN ALL USEFUL COLOURS.
IS IMPERVIOUS TO HEAT, COLD, OR WATER.
IS WITHOUT SMELL.

No expensive Oil or Turpentine required.

WILL NEVER BLISTER.

HAS A COVERING CAPACITY **40** PER CENT. GREATER THAN LEAD PAINTS.

For Outside or Inside Work in any Climate.

Bell's Asbestos Aquol Paint is equally suitable for the finest decorative work as well as for general painting. It can be applied over or under any other paint, and, owing to its easy application, can be used with a large distemper brush; the SAVING THUS EFFECTED IN LABOUR BEING **50** PER CENT. OVER THAT OF LEAD PAINTS.

Bell's Asbestos Aquol Paint is susceptible of the most delicate treatment; and, owing to its perfect flatted surface, it brings up the varnish in a manner that no other paint can equal. ONE COAT OF VARNISH ON **Bell's Asbestos Aquol** IS EQUAL TO TWO COATS ON ORDINARY PAINT.

BELL'S ASBESTOS AQUOL PAINT is specially adapted for Private Houses, Exhibition Buildings, Ships, Churches, Asylums, School Boards, Railway Stations, and all work of Wood, Iron, Cement, Plaster, Stone, Brick, &c., &c.

Those who Study Economy and Protection from Fire should use only

BELL'S ASBESTOS AQUOL PAINT.

BELL'S ASBESTOS AQUOL PRIMING is made Ready for Use.
BELL'S ASBESTOS AQUOL PRIMING stops all suction of Wood, Cement, Plaster, &c.
BELL'S ASBESTOS AQUOL PRIMING should be applied to all New Work.

Suitable for Ceilings, Walls, and New Wood, and is very durable.

BELL'S ASBESTOS AQUOL KNOTTING, for Stopping Knots in New Work.

AN EXCELLENT CURE FOR DAMP WALLS.

Colour Cards and Price Lists on Application.

Supplied in Casks of 5 to 7 cwt., and Iron Drums of 28, 56, and 112 lbs., Sample Tins of 7 and 14 lbs.

Owing to its Covering Capacity, a SAVING IN FREIGHT of 40 per cent. is effected for a given surface.

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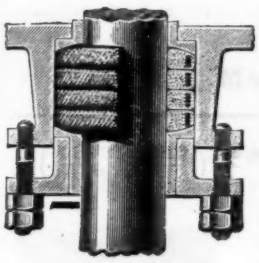
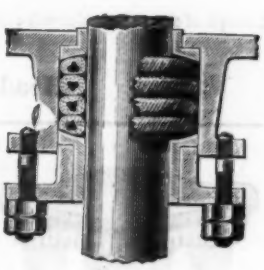
BELL'S ASBESTOS DAGGER DAGGER PACKING PACKING

PATENT No. 15,413.



ROUND



SQUARE. Every 10 feet has Label as above, and bears our Trade Mark.

Under this registered title are included the inventions of Mr. Field; and experience has proved them to be the MOST EFFICIENT DURABLE, and ECONOMICAL PACKINGS ever made. They constitute such a combination of Asbestos and India-rubber as secures the maximum of elasticity and heat resistance; and they are, therefore, UNEQUALLED FOR EVERY KIND OF ENGINE. These Packings are being universally used by most of the leading Steamship Companies throughout the world for ordinary Compound, Triple, and Quadruple Expansion Engines of the latest types. The packings are composed of rolled Asbestos Cloth, but the India-rubber is placed in two forms to suit various cases

IN ORDERING STATE WHETHER SQUARE OR ROUND IS REQUIRED.

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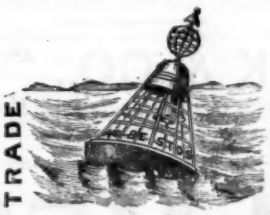

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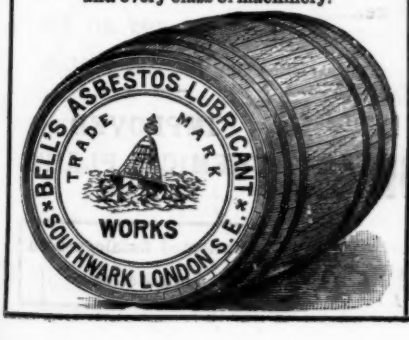
SOUTHWARK, BELL'S ASBESTOS. LONDON, S.E.

BELL'S ASBESTOS
YARN AND SOAPSTONE PACKING
the BEST LOCOMOTIVE PACKING made.

BELL'S
COMPOUND HYDRAULIC PACKING
Is specially suited for
Hydraulic Machinery, Accumulators and Ammonia and all Pumps.

BELL'S ASBESTOS LUBRICANT
Is unequalled
For Steam-Engines & Cylinders, Gas-Engines, and every class of machinery.



BELL'S ASBESTOLINE
The reputation of this Lubricant is based on the experience of thousands of users, which places it far in advance of those who rely only on mere laboratory tests.

ASBESTOLINE IS THE CHEAPEST MOST EFFICIENT, CLEANEST MOST INODOROUS AND SAFEST LUBRICANT.

ASBESTOLINE HAS SAVED 90 PER CENT. OVER OIL.
Has been used for all purposes, AND BEATEN ALL OTHER LUBRICANTS IN ACTUAL WORK.

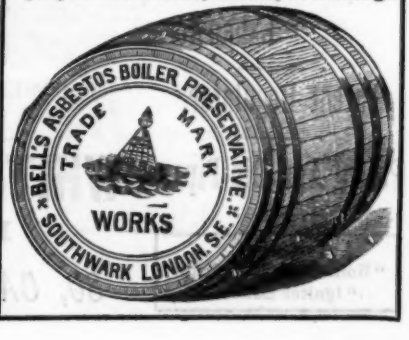
BELL'S ASBESTOS
EXPANSION SHEETING
RINGS, AND TAPE.
Is the most efficient and reliable Material for Manhole, Mudhole, Steam-Pipe, and all other Joints.

BELL'S ASBESTOS
NON-CONDUCTING COMPOSITION.
Will reduce loss by radiation and saves 40 per cent. of fuel.
Is superior to any other, and saves its cost in a few months.

Can be applied again after many years' service.
Is sent out dry in bags; therefore cheaper than others sent out wet.

ALL BAGS ARE MARKED AS ABOVE.

BELL'S ASBESTOS
BOILER PRESERVATIVE
Will effectually keep Boilers clean, and remove any Incrustation, without injury to the Boiler, Plates, or Fittings.



G. J. EVESON,

GAS COAL AND CANNEL CONTRACTOR,

PATENTEE OF

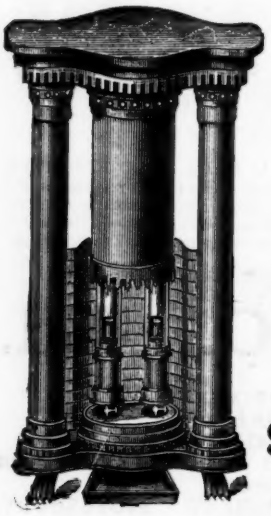
A SPECIAL COMPOUND

FOR THE CURE OF STOPPED ASCENSION-PIPES,

A couple of charges of which will clear a stopped pipe, and an occasional charge keeps them clean, and also increases the make per ton and the illuminating power.

PRICE AND PARTICULARS ON APPLICATION.

Head Office: CORPORATION STREET, BIRMINGHAM.



THE "SYPHON" (REGISTERED TITLE.)

(CLARK'S PATENT.)

Hygienic Gas-Heating Stoves

For Use Without a Flue.

NO FLUE REQUIRED. NO SMOKE. NO SMELL.
NO DIRT OR TROUBLE. NO DANGER.

All sulphurous Vapours are condensed inside the Stoves, and passed off as liquid into the tray beneath.

The "SYPHON" Hygienic Gas-Heating Stoves gives a pure, equable, and agreeable heat which can be graduated and sustained at the will of the user. They are so constructed that a moist or dry atmosphere is obtained at pleasure.

They are the Only Safe Stoves for use in Greenhouses, Conservatories, Bed-rooms, &c., and especially suitable for Halls, Sitting-Rooms, Offices, Shops, Schoolrooms, and Theatres.

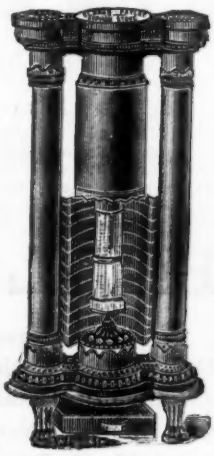
Adopted by the principal Gas Companies throughout the Kingdom.

Illustrated Price Lists on application to

S. CLARK & CO., Patentees and Makers,

Syphon Works, Park Street, Islington, London, N.

Telgraphic Address: "Syphon Stoves London."



W. C. HOLMES & CO.,

CONTRACTING GAS ENGINEERS.

SPECIALITIES.

Patent Regenerative Retort-Settings.

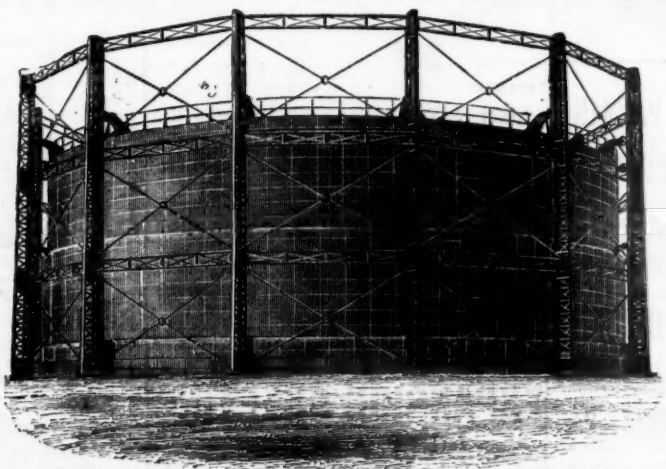
Patent Rotary Scrubber-Washer.

Patent Reciprocating Exhauster.

Patent Regulator.

Patent Anti-Dip Pipes.

Telegrams: "Holmes Huddersfield." "Ignitor London."



Treble-Lift Gasholder, 130 ft. by 66 ft., as erected at Burton-on-Trent, 1889.

WHITESTONE IRON-WORKS,

HUDDERSFIELD,

AND

80, CANNON STREET, LONDON, E.C.

SOLE MAKERS OF

DRAKE'S PATENT

GAS PLANT

Specially adapted for Country Places, and for mixing with Coal Gas to increase Illuminating Power.

Condensers, Scrubbers, Purifiers, and all Fittings for Gas-Works.

IMPROVED CHEMICAL PLANT.

Illustrated Catalogues on application.

HENRY BALFOUR & CO.,

LEVEN, FIFE,

MAKERS OF

GASHOLDERS

And all classes of GAS PLANT,

REVOLVING BRUSH SCRUBBERS, FOUR-WAY VALVES.

LONDON: 13, BILLITER STREET, E.C.

THE THAMES BANK IRON CO.

UPPER GROUND STREET, LONDON, S.E.,

SUPPLY FROM STOCK

CAST-IRON RETORTS,

AND ALL KINDS OF GAS-WORKS APPARATUS.

SOCKET-PIPES FOR GAS OR WATER PURPOSES.

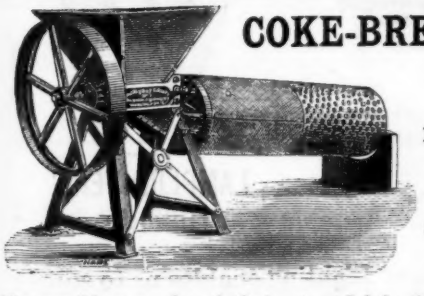
FLANGE PIPES FOR STEAM.

Sole Manufacturers of LYON'S 'PATENT' GAS MAIN SYPHONS.

AGENTS FOR

ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

MATHER'S



COKE-BREAKERS.

USED BY

Ipswich,
Oxford,
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Bedford,
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and Oswestry
Gas-Works,
&c.

These machines are cheap in first cost; and, being fitted with hardened wearing parts, the cost of maintenance is very small. Send for Price Lists and Testimonials.

G. R. MATHER & SON, Engineers, WELLINGBORO'.

S. PONTIFEX & CO.,

GAS and WATER ENGINEERS,

Manufacturers of and Contractors for the Maintenance of

PUBLIC LAMPS & LANTERNS;

GLASS—Flint Opal, and Bent in Stock, and Cut to Sizes.

WELL LAMPS, STREET NAME TABLETS,

LAMP COLUMNS, HEAD IRONS, PUTTYLESS LAMPS,
LANTERN COCKS, REGULATORS.

Improved High-Power Lanterns for Lighting Street Refuges and Open Spaces.

BROWN'S PATENT

LAMPLIGHTERS' TORCHES.

PROPRIETORS AND MANUFACTURERS OF

BOX'S PATENT

PUTTYLESS STREET LAMP.

This Lamp may be supplied fitted with clear opal, or ribbed glass, *as also with enamel tops* if required. The necessary fittings for altering existing Lamps to this system can be supplied at moderate prices.

S. PONTIFEX & CO., 22, COLEMAN ST., LONDON.

Works: 18, STEPHEN STREET, TOTTENHAM COURT ROAD, W.

MEIKLEJOHN'S

Patent

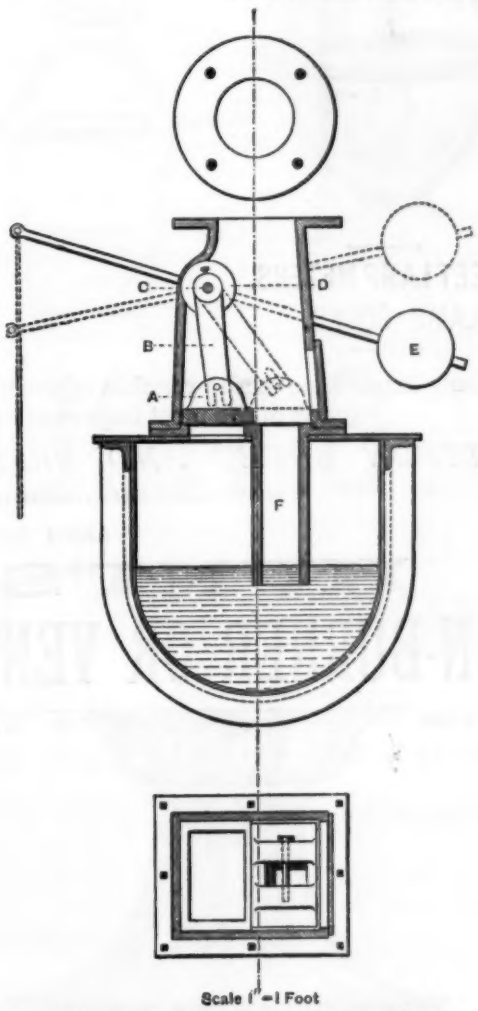
IMPROVED SLIDE-VALVE ANTI-DIP.

MR. THOS. NEWBIGGING'S REPORT.

5, Norfolk Street, Manchester,
Dec. 11, 1889.

SIR,—I have examined your patent Anti-Dip arrangement, and have seen it at work on the Retort-Benches, at the Longwood Gas-Works, and the opinion which I have formed of its simplicity and certainty in working is distinctly favourable; so much so *that I consider it to be, without exception, the most efficient Appliance of the kind which has yet been introduced.* It can be applied to existing Benches with great ease, and at a minimum cost. So far as I am aware, it embodies a principle of action not previously applied in this direction.—Yours truly,

THOS. NEWBIGGING.



Scale 1" = 1 Foot

Is perfectly reliable in action, and requires no attention.
Has all the advantages of the Dip and Anti-Dip combined.
Is cheap, and easily fixed to any form of main.
Will more than save their cost in one season's working.

Further particulars from the Sole Patentee and Manufacturer

NEILL MEIKLEJOHN,

GAS ENGINEER,

LONGWOOD, HUDDERSFIELD.

W. PARKINSON & CO.,

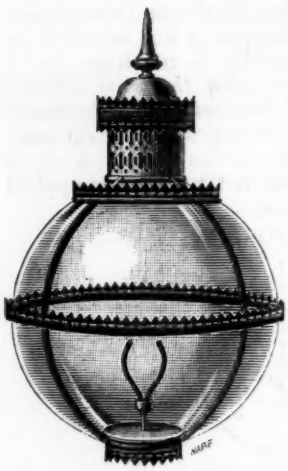
Having purchased the old-established Lamp and Meter Business of

MESSRS. JOHN BENT & SON,

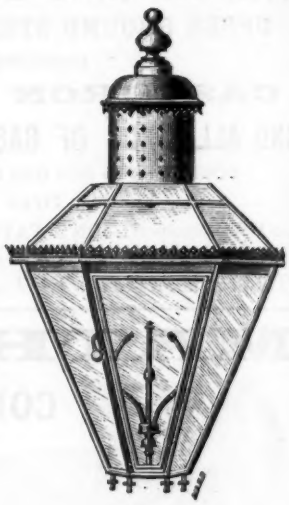
Are now Manufacturers of

IMPROVED LAMPS FOR STREET LIGHTING

IN EVERY SIZE AND STYLE.



STREET LAMP METERS.
LAMP COCKS.



LAMPLIGHTERS' TORCHES.

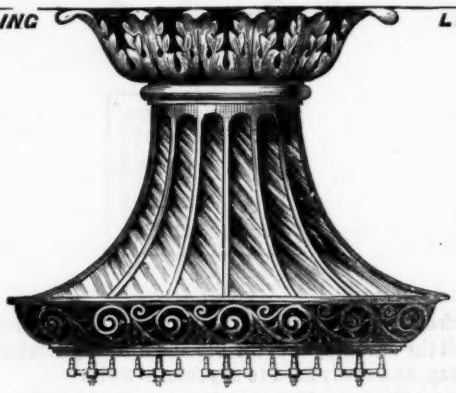
Our long experience in all branches of work connected with Street Lighting enables us to supply goods of the most improved construction, and of the highest quality.

PATTERN SHEET AND REFERENCES SENT ON APPLICATION.

ALSO SOLE MAKERS OF

HUNT'S PATENT

SUN-BURNER OR VENTILATING CEILING LIGHT.



HIGHEST ILLUMINATING POWER AND PERFECT VENTILATION.

ESTIMATES SUBMITTED FOR LIGHTING BUILDINGS OF ANY DIMENSIONS.

VENTILATING FLUES SUPPLIED AND FIXED COMPLETE.

EXTENSIVELY IN USE IN PUBLIC OFFICES, CHURCHES, HALLS, ETC.

ECONOMICAL IN FIRST COST AND VERY DURABLE.

MADE IN VARIOUS SIZES. TESTIMONIALS ON APPLICATION.

COTTAGE LANE WORKS, CITY ROAD,
LONDON.
Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS,
BIRMINGHAM.
Telegraphic Address: "GAS-METERS."

OFFICE: 10, MAWSON'S CHAMBERS, DEANSGATE,
MANCHESTER.
Telegraphic Address: "PRECISION."
(See also Advt. p. I 130.

London: Printed by WALTER KING (at the Office of Hing, Sell, and Railton, Ltd., 12, Gough Square); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Dec. 2, 1890.